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First Person Perceptions on Intelligence, Cognition, and Sensory Processing in Autism

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ABSTRACT

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In this study, beginning with a comprehensive review of the evidence-based literature, I employed a qualitative, grounded theory methodology, interpreted within Social Constructivism to explore the perceptions of 17 adults with autism spectrum disorders for their thoughts on the topics of intelligence, cognition, and sensory processing. Using a three-stage coding procedure, I arrived at 52 initial categories that narrowed and condensed into one foundational category and five primary categories supported by a number of secondary categories. Then, using the five categories of sensory, focus, memory, cognitive, and social, I arrived at a Theory of Sensory-Cognitive Difference that I believe to be superior to any existing theories that have attempted to explain autism through the years. The core elements within this theory suggest that significant sensory processing differences are filtered and interpreted differently. Focus, which is primarily, interest-based, then works alongside of a different memory system, that is prodigious in detail but narrow in scope. These combine recursively and are reinforced by a different cognitive processing system that specializes in hyper-focusing, recognizing patterns and anomalies, and analyzing pieces and parts to create and envision the big-picture. Combined, these differences contribute to a different sense of purpose and value that plays out most in the social arena. A variety of subcategories detail

challenges and the struggles for those represented within the proposed Theory of Sensory-Cognitive Difference and these offer insight into a deeper understanding about the condition for those affected. Finally, the implications of this research suggest that existing cognitive-behavioral theories attempting to explain autism lack the breadth and specificity to capture the full range of cognitive and sensory difference that appears to be present for those in this study. The study concludes with a summary and a discussion that offers, recommendations, and suggestions for future research to expand on the value of the proposed theory.

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CHAPTER I

INTRODUCTION

Why Study Cognition, Intelligence, and Sensory Processing in Autism?

For over 70 years, the continuum of autism has puzzled researchers and clinicians alike. Once believed to affect only 4 in every 10,000 individuals (McMahon & Ritvo, 1989), figures from 2014 indicated that the incidence of autism spectrum disorders (ASD) is now at approximately 1 in 68 (Centers for Disease Control [CDC], 2014). Moreover, with what was considered only five years ago to be a low-incidence disability, ASD is now racing to the top of the disability frequency charts, according to the incidence numbers, with a momentum that could quickly place it in competition with learning disability and attention deficit disorder for the expenditure of time, attention, and resources of educators and mental health professionals

Through the years, as those exploring the condition have sought to understand it and develop programs and supports for those affected, ASD has become one of the most heavily explored research topics within the social sciences. A Google Scholar search suggested that some 685,000 studies have considered the condition, in some form or other, to date. But, while much has been done to describe the disorder and give foundation to its etiology (Currenti, 2010) as well as to maintain an accurate diagnostic picture about the condition (Risi et al., 2006), much is still not understood about the

disorder's intellectual, cognitive, and sensory effects (Ayres, 1979; Baron-Cohen, Wheelwright, Burtenshaw, & Hobson, 2007). What is agreed upon, across a vast literature base, is that ASD has a severe and negative impact on both socialization and learning. Furthermore, while individuals with autism can have varying degrees of intelligence (Treffert, 1988), nearly 75% of those with ASD are found to be intellectually disabled when tested using standardized intelligence quotient (IQ) assessment instruments (Larson et al., 2001, McMahon & Ritvo, 1989).

In the past decade, however, numerous studies have begun to question the validity of using standardized IQ tests to predict cognitive ability for those on the autism spectrum. According to numerous researchers, sensory differences including hyper-acuity, auditory-processing and discrimination deficits, oral-motor language production issues, visual and visual-motor output problems, and gross as well as fine motor coordination and planning issues routinely have a negative effect on the scores (Hippler & Klicpera, 2003; Provost, Lopez, & Heimerl, 2007; Scheuffgen, Happé, Anderson, & Frith, 2000; Weimer, Schatz, Lincoln, Ballantyne, & Trauner, 2001). Others suggested that sensory-based challenges combine with several different core cognitive processing differences to increase the amount of time that individuals with ASD need to think, process, organize, reason, and perform tasks of mental processing speed (Hippler & Klicpera, 2003; Provost, Lopez, & Heimerl, 2007; Scheuffgent et al., 2000; Weimer et al., 2001). Facon (2008) and Lord et al. (1989) added that while IQ is relatively stable throughout the lifespan for most neuro-typical individuals, as sensory and cognitive skills mature for those with ASD, IQ test scores improve dramatically.

Statement of the Problem

Unfortunately, the majority of individuals diagnosed with autism spectrum disorders receive their first evaluation to estimate cognitive functioning using standardized IQ tests when they are young and often before their sensory and cognitive skills are mature (Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991). Using these norm-referenced testing instruments and standardized testing procedures, individuals with autism most often present with below average IQ scores which are then used to predict their overall cognitive abilities (Larsen et al. 2001). However, for a number of reasons, it is possible that IQ tests do not accurately predict cognition for this population (Bartak & Rutter, 1976; Colom, Escorial, Shih, & Privado, 2007; Helms, 1992; Joseph, Tager-Flusberg, & Lord, 2002; Kanaya, Scullin, & Ceci, 2003; Manjiviona & Prior, 1999; Preckel, Holling, & Vock; 2006; Sternberg, Grigorenko, & Bundy, 2001). Yet, even though the scores might be invalid for those with ASD, IQ scores continue to be accepted as accurate and lead those using them to assume innate cognitive potential for those with ASD. These assumptions are then used to plan educational programs and drive expectations for years to come, often well into the adult life of the ASD individual (br, Bryson, Boyle, Streiner, & Duku, 2003).

With the possibility that IQ scores do not accurately predict cognitive functioning for those with ASD, this inquiry explored basic assumptions about intelligence in autism by qualitatively considering the perceptions and experiences of individuals with ASD. The study's purpose was to gain information from those with the ASD condition about their life experiences and the perceptions on the topics of intelligence, cognition, and sensory processing.

Purpose of the Study

In the evidence-based literature, very few qualitative first-person accounts of the autism condition are included across a vast collection of research (Babiracki, 2002). Furthermore, based on an extensive review of the literature, although there is a pervasive thread of support for the possibility of high-but-latent cognitive ability in ASD, it appears that no studies to date have yet considered the topic of intelligence (particularly as it has been defined by the IQ test instruments used to assess it) from the perspective of first-person experiences of those with ASD. Furthermore the topic of intelligence has never been explored for its relationship to the cognitive and sensory processing differences that are reported in those with ASD. For these reasons, a qualitative, grounded theory study bound within the theoretical tradition of social constructionism was proposed as the selected methodology for this inquiry. Using this method, I explored the existing evidence-based literature across these broad topics; then based on that literature, I both inductively and deductively considered the life experiences of 13 adults with ASD to understand their life experiences and perceptions about these topics to better understand the conditions of autism and to consider the relationships between intelligence, cognition, and sensory processing for those with ASD. Within this research, I then grounded a theory with the help of those with ASD about perceptions and relationships as they pertain to intelligence, cognition, and sensory processing in ASD.

Research Questions

Because this study intended to discover, explore, and understand the first-person perceptions and lived experiences of 17 individuals with ASD for their perceptions

regarding intelligence, cognition, and sensory processing difference, the research questions for this inquiry were as follows:

Q1 What perceptions do individuals with ASD have, based on their life experiences, about their intelligence and their ability to demonstrate their intelligence through standardized IQ tests?

Q2 What perceptions do individuals with ASD have, based on their life experiences, about their cognitive abilities and differences?

Q3 What perceptions do individuals with ASD have, based on their life experiences, about their sensory differences and difficulties?

Q4 What perceptions do individuals with ASD have, based on their life experiences, about the relationships that exist between measured intelligence, cognition, and sensory processing for individuals with ASD?

Significance of the Research

This research is significant because perceptions about intelligence, namely the assumption that the majority of individuals with ASD are intellectually disabled, influences scholarly inquiry on the subject, drives educational and vocational expectations, and instills patterns of learning and functioning that often dictate opportunity in adult life. But, if those with ASD possess higher cognitive abilities than expected (i.e., not as many are truly intellectually disabled) even though their sensory skills negate the demonstration of their intelligence on IQ tests, this study could potentially shift perceptions about the possible range of abilities and potentials that might be present for individuals on the spectrum of autism. Within this scope, researchers, educators, therapists, mental health workers, family members, and friends would all benefit from an increased understanding about the different-mindedness that potentially belies the autism condition and regarding the impact of cognitive and sensory difference on the demonstration of traditional intelligence for those with ASD. In turn, broadened

constructs about intelligence in ASD toward those that are inclusive of potential and strength present in the cognitive and sensory differences of those with ASD could eventually open new doors for research and understanding about ASD that, in turn, could lead toward more fulfilling lives for ASD individuals.

To date, the topic of intelligence, as measured through IQ test scores, has never been seriously considered within the context of cognitive and sensory difference for those with ASD. While it might be true that the majority of individuals with autism have measured IQ scores that place them in the intellectually disabled ranges of functioning (Larson et al., 2001), problems with narrow definitions of intelligence, alongside cognitive and sensory processing differences that negatively affect how those with ASD perform on IQ tests, potentially lead to a mismatch between test scores and the real identification and pursuit of strengths, abilities, and potentials for those with ASD.

Therefore, with underlying questions throughout the literature about a possible relationship between autism and latent-yet-high cognitive ability in ASD in spite of cognitive and sensory processing differences, the purpose of this study was two-fold. First, I detailed the evidence-based literature for the topics of intelligence, cognition, and sensory processing for those with ASD; then with the existing research in hand and using a qualitative, grounded theory methodology, I explored the perceptions of 13 adults with ASD to understand their underlying thoughts, feelings, experiences, and perceptions to explore relationships and to increase understanding about IQ tests and the impact of cognitive and sensory processing difference on demonstrating intelligence for those with ASD.

My Role as Researcher

Merriam (1998) stated that one purpose of qualitative research is to gain an understanding about certain conditions by exploring the ways that people who live with them experience and give meaning to their differences. In looking back across the years, I first began the informal inquiry into understanding the perceptions and experiences of those with ASD nearly 25 years ago and since, I have wrestled with unresolved questions about latent cognitive abilities in ASD, both personally and professionally. In my career, I have seen over 1,000 individuals with ASD and even those who were very low functioning and non-verbal demonstrated some unusually high cognitive aptitudes. In a 25-year career, I have never seen a single individual who I would consider severely intellectually impaired, in spite of their IQ scores.

Merriam (1998) added that within qualitative inquiries, the researcher becomes the primary research instrument in the study. Over the years, and mostly without intent, I believed that my emic perspective on ASD developed alongside my social and historical constructivist world-view to guide me towards this research. Moreover, it seems that for all of my adult life, I have been curious to understand and construct meaning about autism from the perspectives of those diagnosed. Trochim and Donnelly (2001) added that it is through these very life-long interests and curiosities that qualitative research perspectives often emerge.

Over 20 years ago, at the beginning of my career, I was a skills trainer for one of the country's first ABA therapy treatments centers for autism. Children from all over the United States flocked to Utah, and in the four years that I was there, I saw 100s of children diagnosed with autism. Back then, though, I only *felt in my gut* that the kids I

worked with were not as cognitively low functioning as their IQ scores suggested. During those years, I saw so many children with IQ scores below 40 that I stopped paying attention to the numbers. I later helped to take on the "lowest functioning" six members of the Utah State Hospital system as they made their transitions to a group home. It was a position with overnight responsibilities and though I won't detail all of the more challenging aspects of that job, I can honestly say that in spite of being non-verbal, these six *out thought* most of the staff that worked with them on a daily basis.

After working my way through the ranks in clinics, hospitals, and group homes, I graduated from a doctoral level sequence of coursework in school psychology with dual Master's degrees in educational and school psychology. With two young children in tow in 1994, I started a private practice as a school psychologist specializing in twice-exceptionality where I routinely assessed and provided educational consultation and advocacy for individuals who were highly intelligent, yet disabled. There, in a 20-year span of time, I encountered over 300 youth diagnosed with high-functioning autism and/or Asperger syndrome. In later years, I also owned and operated the country's first twice-exceptional school. Since my beginnings at the Children's Behavioral Therapy Unit in 1987, I have seen over 4500 youth; and through the years, a full quarter of my clients have been diagnosed with the conditions of autism. Across these years, while only a few of those with ASD had IQ scores that cleanly placed them into the high-ability ranges of functioning on any measure, I have now been privileged to witness countless "low" and "high functioning" as well as "gifted" children with ASD *survive* their childhoods and grow up to become unusually, yet surprisingly "intelligent" and even highly successful adults.

But, while my work experiences were consistent with many others with my training, I think that what made my view unique was that in these same years, I also sustained a traumatic brain injury (TBI), which seriously impaired my sensory processing and executive functioning systems. After my injuries, I found that I could more closely relate to my ASD clients because I also experienced many of their same sensory-based issues and challenges with executive functioning. In the years following my TBI, I found myself rocking, squeezing my hands, avoiding high-frequency sounds, and craving weight and pressure; and with these, I became a strong national advocate for sensory accommodations for those with ASD. I also found that I needed a personal assistant to keep me operational in my practice. Like my clients, I was easily overloaded, irritable, and quick to escape when I was tired or overwhelmed. Those who knew me before and after also reported a significant deterioration in my social skills after my accident. I did not always agree; but, I did recognize that being around people socially made me very tired. Moreover and based on neuropsychological testing done to document my injuries for a legal proceeding, I was also astonished to learn that my IQ had dropped 33 points from testing done during my coursework in college. Embarrassed by my post-TBI IQ scores, I remember begging the neuropsychologist to please explain that I was not really "cognitively, slightly below average."

In spite of my reports of "lower than average intelligence," my career continued, and eight years ago, after successfully presenting to a standing-room-only session at the United States Autism and Asperger Association's World Conference in Denver, I was asked to join the USAAA advisory board. It was through this organization that my thoughts about IQ tests and cognitive/sensory difference in ASD finally came together.

In one *aha* moment that arrived as Temple Grandin, a university professor, leading autism expert, and author of numerous books, made an off-hand comment stating that NASA and MIT were in all likelihood "sheltered workplaces for individuals with autism" (Grandin, 2010, September). While at first I thought she may have made the comment as a joke (I learned later that she does not often tell jokes), I realized that the underlying possibility of a relationship between high-but-latent cognitive ability, in spite of IQ scores, was not only possible, but was even proposed by Kanner (1943) and Asperger (1944) for those with ASD from the outset. Then as Grandin continued to discuss differences in cognitive learning styles and sensory processing differences for those with ASD, I arrived at a personal conclusion. It seemed that the various ways that cognitive and sensory processing differences can combine for those with ASD (and maybe even as they had done for me) might, in fact, explain why so many of my clients had found success, even though their IQ scores had predicted otherwise. In the years that followed, I carried this idea forward and when I resolved to complete my doctoral degree in special education, I knew I would consider intelligence in ASD, in one form or another, for my dissertation. But, it wasn't until I combed the three topics (intelligence, cognition, and sensory processing) in ASD through an extensive scientific literature review for my major paper (a requirement in our department) that I realized these relationships had never been seriously considered in combination for their relationship for individuals with ASD.

So, while it might still be true that the majority of individuals with autism have measured IQ scores that place them in the intellectually disabled ranges of functioning (Larson et al., 2001), I felt my role as researcher (given both my professional training and

experience as well as my personal life circumstances) uniquely positioned me to consider first-person perceptions about intelligence, cognition, and sensory processing difference for their interaction and relationship in adults diagnosed with ASD.

Research Stance and Theoretical Perspective

For me, knowing is an active, historical, and socio-cultural process. As a researcher, I view the world from the ontological perspective that as humans, we can only know and understand our reality through our shared perspectives of it; I believe this makes me a subtle realist (Blaikie, 2007). Moreover, in my world-view, personal *knowing* comes from an inductive, bottom-up position of observing the world, constructing and creating realities, then sharing and testing them with others to arrive at a coherence of truth (Crotty 1998). Thus, for me, actual meaning emerges only when shared consciousness engages with it (Crotty, 1998).

Trochim and Donnelly (2001) suggested that a researcher's theoretical perspectives comes from the realm between what goes on inside of one's head and what they observe in the external world. With that introduction, several seemingly scattered and unrelated theories, along with years of observation, have established my theoretical perspective as one of social constructionism for this research topic. Within the qualitative tradition, there are a number of formal approaches to conducting an inquiry. In this research, I let Creswell (2013) guide my research approach towards a grounded theory study. I believe this method gave the study a path toward describing, understanding, and formulating a theory about difference in ASD that was built from the shared perspectives of self-as-researcher working alongside those who live with the condition of ASD to explore and create new understanding (Stake, 1995).

Relevant Concepts, Terms, and Definitions

According to Robertson (2013), Aristotle first promoted empirical observation, and his views were forwarded by Sir Francis Bacon through the concept of deductive reasoning. These men led early 17th and 18th century taxonomists toward a system of grouping and categorizing the natural world that continues today. Yet within deductive accounting, according to Stent (1975), early scientists, like the scientists of today, often arrived at vastly different and even opposing perspectives, especially when they applied this new form of reasoning to the field of social science. Still, following a tradition of reductionism and within a definition of truth that is based solely on observation, today's researchers, educators, and mental health practitioners often continue to rely on those early classification systems to place all things human onto a continuum. In so doing, *disorders* are defined and diagnosed to serve as a framework and common ground whereby all discussions about conditions that affect *normal* development can occur. To this day, the language of the early philosophers, spoken through modern-day categorization systems, continues to serve as the foundation for the majority of inquiries in the field of human development.

But, as anyone who has ever read the scientific literature knows, agreement about even the simplest of definitions and diagnostic features is often not met. Through the years, this has been especially true for the conditions of autism. Thus, while much of this study, in fact, strove to call into question existing and deductive assumptions and, instead, put forth inductive thought and insight regarding the proposed research topics, the use of deductive categorical definitions was used to give clarity to the terms that were

used in the research and to place the reader on common ground with the study's language. For this inquiry I selected the following definitions for each of the primary terms considered in the study. My selection of terms and their definitions follows.

Ability. According to the Merriam-Webster collegiate dictionary (2005) ability has three separate definitions that while similar, account for a difference of agreement about what the term actually means. The first of these suggests that ability is the specific quality or state of being able (physically or mentally) to perform. The second aligns ability with competence and skill; and a third definition delineates ability as a natural aptitude or acquired proficiency. Given that this study was particularly interested in both natural aptitudes and the development of acquired performance, specifically considering these for their inherent differences, the term ability in this study was used broadly to include all three definitions, with reservation of the term *latent ability* assigned to those natural aptitudes that are, as of yet, not fully developed.

Autism. Using the broadest (and likely oldest) of all definitions, this study defined autism as it has been defined within the Merriam-Webster collegiate dictionary (2005) as "a condition or disorder that begins in childhood and causes problems in forming relationships and communicating with other people."

Asperger syndrome. Now considered to be an essentially "defunct diagnoses" (American Psychiatric Association (APA) (2013)), Asperger syndrome, as it was originally proposed by Wing (1981), was defined within this proposal as the diagnostic name given to explain the problems of children and adults who exhibited autistic features, but talked grammatically, and yet, were socially aloof. In her original

report, Wing (1981) added, these individuals have been especially difficult to identify, because those who have worked with them often believe that autism is defined by mutism or total social withdrawal. Wing suggested the use of Asperger's syndrome for the condition, to credit the work of Hans Asperger (1944), the first physician to report on individuals exhibiting these conditions. Asperger syndrome was adopted for clinical use in the third edition of the *Diagnostic and Statistical Manual of Mental Health Disorders* (American Psychiatric Association, 1980), but the condition was not diagnosed until June of 2014 when the 5th edition of the *Diagnostic and Statistical Manual of Mental Health Disorders* (American Psychiatric Association, 2013) was released. DSM-5 incorporates the core features of Asperger syndrome into the broader category of autism spectrum disorder (APA, 2013).

Autistic savant. Treffert (1988), one of the primary researchers on the topic of savant syndrome in autism, provided the following definition of the autistic savant: "a juxtaposition of severe mental handicap and prodigious mental ability" (p. 563). While somewhat controversial, particularly for the assumption that savant skills are derived within high or even prodigious mental abilities, this definition was used for the research.

Autism spectrum disorder (ASD). ASD is the currently approved DSM-5 term for the full continuum of developmental disorders that manifests with: communication deficits (responding inappropriately in conversations, misreading nonverbal interactions, or having difficulty building age-appropriate friendships); over dependence on routines; high sensitivity to changes in the environment; and

intense focus that is often inappropriate (APA, 2013). Within this definition, the symptoms of people with ASD are believed to fall on a continuum, from mild to severe, and these symptoms must be present by early childhood, even if they are not recognized until later according to the APA (2013). The current definition, adopted professionally in June of 2014, is a criteria change from previous definitions adopted to encourage earlier diagnosis of ASD while also recognizing people whose symptoms might not be fully recognized until later, when social demands exceed their capacity to receive the diagnosis (APA, 2013). Both Asperger syndrome and the previously diagnosed umbrella term "Pervasive Developmental Disorder Not Otherwise Specified" were eliminated in the revision (DSM-V, 2014) to include those individuals, with the very highest functioning forms of autism. Specifically for those individuals who would not otherwise meet criteria for ASD, given normal expressive language development, the diagnoses of "Social Communication Disorder" was also added to DSM-V (APA, 2013).

Cognition. In its most complete and simplest form, the definition "all of our mental abilities" (Glass & Holyoak, 1986, p. 2) was adopted as the definition of cognition for this research.

Constructionism* and *Constructivism. The terms constructivism and constructionism are often used interchangeably, particularly within discussions about theoretical frameworks throughout the literature. However, for clarity, I chose to follow Crotty's (1998) delineation of these terms which specifies that constructionism can be distinguished from constructivism as the "collective generation and

transmission of meaning" (p. 58), instead of just the "meaning making activity of the individual" (p. 58). Therefore, throughout this paper, the term constructivism was applied to both the grounded theory methodology that was used in the study as well as to the meaning-making process for the individual; and constructionism was used to depict the shared construction and creation process between myself and my research participants.

Gifted. While there is not a universally accepted definition of giftedness, according to the National Association for Gifted Children (NAGC):

> Gifted individuals are those who demonstrate outstanding levels of aptitude (defined as an exceptional ability to reason and learn) or competence (documented performance or achievement in top 10% or rarer) in one or more domains (NAGC, 2010, p. 1).

NAGC furthered that the domains in which an individual can demonstrate giftedness include "any structured area of activity with its own symbol system (e.g., mathematics, music, language) and/or set of sensorimotor skills (e.g., painting, dance, sports)" (NAGC, 2010, p. 1). NAGC added within its definition that:

> Some gifted individuals with exceptional aptitude may not demonstrate outstanding levels of achievement . . . due to physical or learning disabilities . . . [therefore] identification of these students will need to emphasize aptitude rather than relying only on demonstrated achievement. (NAGC, 2010, p. 1)

This definition was supported by Brown et al. (2005). The current federal definition of the term recognizes that high achievement in areas such as intellectual, creative, artistic, or leadership capacity or in specific academic fields is combined with the need for services or activities not ordinarily provided by the school in order to fully develop those capabilities constituted giftedness (No Child

Left Behind Act of 2001). Within this research, the broad federal definition currently in use for the term giftedness was applied to the inquiry.

Grounded theory. Grounded theory is a term most often associated with a specific set of systematic and inductive methods for conducting qualitative research that utilizes strong empirical foundations in the pursuit of answering research questions. As such, the primary goal of grounded theory study is to analyze the data in such a way as to construct new theory that is then able to explain the research phenomena in question (Charmaz, 2009). Within grounded theory methodologies, researchers might utilize flexible research procedures in general, yet when it comes to the collection and analysis of the data, these are handled within explicit, sequential guidelines. More specifically, unlike other forms of qualitative inquiry, grounded theory research follows detailed guidelines to establish how researchers will handle and analyze the data, integrate and streamline their analysis, construct the conceptual findings that will be forwarded as themes, and legitimize the constructed theory toward the advancement of scientific inquiry (Charmaz, 2009). While there is some dispute about the exact methodologies that should be applied when conducting grounded theory research, even when these are considered among its proponents, I chose to adhere to the constructivist methodology of grounded theory research as it was proposed and forwarded by Charmaz (1995, 2006). Using this constructivist branch, the term grounded theory, as used throughout this paper, specifically applies to the grounded theory method as it has been detailed by Charmaz (1995).

Intelligence. For this research, as it has been formally defined in the historical literature for nearly 100 years, intelligence was defined as the specific and relatively independent group of brain functions that have the ability to predict academic achievement and, thereby, dictate occupational success (Spearman & Spearman, 1973; Ryan, Sautter, Capps, Meneese, & Barth, 1992). Within this definition, the broader definitions of intelligence such as Gardner's (1993) theories on multiple intelligence was not formally considered or discussed in this research.

Intelligence quotient (IQ). Using the most recent Wechsler (2003) definition, an individual's IQ is "the composite of (IQ) test scores that assesses cognitive functioning in several specific cognitive domains and provides valid numbers that represent one's overall, general intellectual ability" (p. 1).

Sensory processing. Sensory processing, as it was used in this research, was defined as the "neurological process that organizes sensations from one's own body and from the environment making it possible to use the body effectively within the environment" (Ayres, 1972, p. 11). Within this definition, the assumption that sensory processing acts as the primary interface between the internal workings of the cognitive processing system and the outward demonstration of ability through oral or visual-motor functioning, as described by Minshew, Goldstein, and Siegel (1997), is clearly indicated.

Twice-Exceptionality. According to the NEA (2006), twice exceptional (2e) individuals have both exceptional ability and disability. According to Baldwin, Omdal, and Pereles (2015) this definition of twice-exceptionality suggested that the condition results "in a unique set of circumstances; their exceptional ability may dominate,

hiding their disability; their disability may dominate, hiding their exceptional ability; each may mask the other so that neither is recognized or addressed" (p. 3). In previous definitions, the National Education Association (NEA) also suggested that twice-exceptionality is characterized by asynchronous cognitive development that is accompanied by demonstrated evidence of learning, social, emotional, sensory, or behavioral conditions that significantly interfere with successful school performance (NEA, 2006). Under special education law, IDEA (2004) recognized 13 disability categories (United States Department of Education, 2004) and within these, ASD is recognized as a disabling condition that can occur in children who are gifted. However, the NEA (2006) also recognized that challenges in identification may occur and cited Baum (1990), adding three categories from which twice-exceptional students may be found. These include: (a) formally identified as gifted, but not having an identified disability—giftedness masks disability; (b) formally identified as having a disability, but not gifted—disability masks giftedness; (c) not formally identified as gifted or disabled—components mask one another—giftedness and the disability not readily apparent. The NEA (2006) recommended that, given the complexity of identifying twice-exceptional learners, a variety of different assessments, formal and informal observations, and reports from those who are familiar with the individual be used to make any identification decisions.

Using these deductive terms and definitions, it should be noted that the intent of this inquiry was to open up a discussion with those diagnosed with ASD. The purpose of

this discussion was to inductively question some of the basic terminology and assumptions that have been used to define autism through the years.

CHAPTER II

CONCEPTUAL FOUNDATION AND LITERATURE REVIEW

Seventy-Five Years of Autism Research

For over 70 years and across the entire spectrum of autism, views on intelligence, cognition, and sensory processing have interacted within changing terminologies and diagnostic criteria to confound understanding about latent ability for those affected by the condition of autism. Moreover, with no shortage of studies (nearly 700,000 and counting), researchers, clinicians, and educators continue to disagree on both the diagnostic features of ASD and on the characteristics of *normal* difference that occur for those with ASD. These disagreements have been especially prominent as they pertain to the potential for inherent-yet-latent abilities across the autism spectrum. But with broad disagreement about even the primary characteristics of cognitive and sensory difference that can occur in ASD, it is no wonder that the exploration of these for their impact on performance in standardized IQ testing is still largely misunderstood.

For these reasons, the literature review for this study focused on the body of literature across the past 75 years (from the time of Kanner and Asperger) to identify the most prominent studies and to detail the primary research trends that have occurred within the study of ASD for the topics of intelligence, cognition, and sensory processing. Given that the topics of this study were broad, the review intentionally opens each section

of the review with a foundation for the topic before introducing the topic for its applicability to ASD. Within this review, historical reports, seminal papers, and several books were used to create a foundation for each topic before the review examined the evidence-based research trends for the more specific aspects of the topics of inquiry. Research on the proposed topics was conducted through standard search engines that included Google Scholar, EBSCO Host, ERIC Pro Quest, and Pro Quest for Dissertations and Theses. The review concludes with a summary about what is known and what is still lacking in the research for the research topics that were considered within this inquiry.

Changing Diagnostic Pictures in Autism

Through the years, the history of autism, as it has unfolded clinically, formed a necessary foundation for this research. With the topics of intelligence, cognition, and sensory processing in mind, it was helpful to note that while the first clinical reports of autism appeared in the mid 1940s, at least two centuries earlier, several accounts of conditions now associated with autistic savants were reported under the topic of *oddity* and *genius*. Perhaps more than any other known disorder, the conditions of autism have gone through a remarkable journey of change, both clinically and in their general understanding. Therefore, with the intention of providing the reader with the historical foundation considered for the research topic, the primary points along the evolution in history for autism are detailed in the following sections.

Kanner's Autism

Reported by Leo Kanner in 1943 in his publication *Autistic Disturbances of Affective Contact*, the first written account of individuals with autism was entered into the scientific literature in the form of an 11-subject case study where the children within the

study were believed to suffer from a new form of childhood schizophrenia. In a detailed 35-page paper, Kanner individually described the "fascinating peculiarities" (p. 217) of eight boys and three girls who presented with an "outstanding, 'pathognomonic,' fundamental disorder" described by Kanner as the "children's inability to relate themselves in the ordinary way to people and situations from the beginning of life" (Kanner, 1943, p. 242). As would be expected, given what we still understand about autism, Kanner described the following primary problems for the children in his study as follows: (a) preferring to be alone; (b) failure to adopt positive anticipatory postures to being picked up or held; (c) delayed speech or the inability to speak, along with parrot-like responses in speech; (d) fear of loud noises; (e) monotonous and repetitious motions; (f) insistence on sameness; and (g) a lack of normally responding to people.

But with "Kanner's autism" generally viewed today as the lower-functioning variety of ASD (Wing, 1981), what is surprising and essentially lost from main-stream knowledge regarding Kanner's reports are his depictions of "good cognitive potentialities" (Kanner, 1943, p. 247). In reviewing his original paper across all cases, Kanner observed excellent memory skills in all of the children he studied, and many of his cases also showed good vocabulary. Additional ties to either high potential or giftedness were reported in 9 of the 11 cases. For example, in case number one, Kanner (1943) reported that Donald T. "could hum and sing many tunes accurately" (p. 217) before his first birthday. Donald also had an unusual memory for faces and apparently could match people's names to their houses for everyone in his town. He was also interested in pictures and by the age of 5, could correctly name almost all of the images

presented to him from the *Comptom's Encyclopedia*. The subsequent 10 cases reported similar trends for high potential.

According to Kanner (1943), the majority of the cases came from highly educated and professional parents; several worked as university professors. Frederick, one of the other children in the study, reportedly came from "a long line of the genius type" (p. 223), and Richard's family "in both branches, consisted of intelligent, professional people" (Kanner, 1943, p. 225). Additional references to high potential included a report of one of the children scoring two years above grade level on reading tests, while another with a reported IQ of 94 was "without a doubt" (p. 230) much more intelligent than her scores suggested. Kanner's 11 cases even included a boy who "achieved an IQ of 140" (p. 234). In his concluding statements, Kanner added that remarkably, the parents of the cases all showed high intelligence and the majority of the mothers of these children were well educated. Kanner's initial assumptions and impressions about intelligence in autism were essentially dismissed though, based on the belief that the selected group of families who found Kanner were predisposed to be from higher social classes or intellectual occupations (Schopler Andrews, & Strupp, 1979).

Yet, Kanner's (1943) position on familial intelligence in autism was so prominent that Bettleheim (1967), with no additional research of his own, concluded that autism was a disorder that occurred only within certain high socio-economic groups where intelligent, professional mothers had failed to provide adequate nurturing and, thereby, created the disorder in their children (Tinbergen & Tinbergen, 1972). This lead to a widely accepted, albeit short-lived, theory that autism was caused by "cold refrigerator mothers" (Kint, 1977). Fortunately, Bettleheim's theory was put to rest by Schopler,

Andrews and Strupp (1979); but with it, Kanner's (1943) position that underlying and possibly even gifted levels of potential in autism was passed over when the focus of autism turned towards deficits in behavior and language development (Kanner, 1971).

Asperger Syndrome

During the same years that Kanner (1943) presented his reports on autism, the Austrian physician Hans Asperger (1944) also put forth a number of cases that he specifically described as highly intelligent individuals with impairments in social interaction. Two things are surprising about the work of Asperger. The first is that until recently, it was believed that Kanner and Asperger never crossed paths (Wing, 1981); and the second is that within analytical reports that have compared the two case studies, the accounting of autism within the archival records of these two clinicians is remarkably similar (Miller & Ozonoff, 1997). In other words, for many decades, while it was believed that Asperger (1944) was associated with a higher-functioning variant of ASD and Kanner (1943) with the more severe and low-functioning form of autism (Wing, 1981), based on reports of those who reviewed clinical notes and actual case files, it is still not agreed upon whether or not there was any difference at all between the severely impaired cases of Kanner (1943) and the highly intelligent clients of Asperger (1944). In retrospect then, it was not surprising when Silberman (2015) in his research for the book *NeuroTribes* uncovered the fact that Kanner and Asperger shared the same research associate.

Wing (1981), one of the first individuals to consider the client files and case notes of Kanner (1943) and Asperger (1944), conducted her research on the conditions of the autism spectrum and found significant differences between those described by Kanner

and Asperger. In her hallmark paper, *Asperger Syndrome: A Clinical Account*, Wing (1981) identified distinct clinical features for a condition that she believed was different than the one described by Kanner (1943). Her paper contrasted the course of autism, its etiology, and proposed a differential diagnosis for a condition she believed should be credited to Asperger. Previously referred to by Asperger (1944) as *autistic psychopathy,* Wing believed that up to that time, the work of Asperger had never yet been considered because of misunderstandings in terms which had resulted in the tendency to equate Asperger's (1944) *psychopathy* with sociopathic behavior; which to most clinicians and researchers did not seem to typify the higher-functioning condition of autism.

According to Wing (1981), the key features that differentiated Asperger's Syndrome from Kanner's (1943) autism were detailed as follows: (a) the condition is not recognized in infancy, and symptoms are often not seen before the third year of life; (b) speech develops normally, although the content of speech is often abnormal; (c) two-way social interaction is impaired, but not because of the desire to withdraw from social contact, but instead social impairment occurred due to lack of understanding; (d) gross motor movements are clumsy and poorly coordinated; (e) preoccupations and interests exist that generally focus on content subjects, such as a particular topic in science, the history of facts, or characters on television programs; and (d) the impression of eccentricity.

Within her report, Wing (1981) also included a discussion about Asperger's belief that the condition he observed (similar to Kanner's 1943 report) was genetically transmitted and had the tendency to run in highly intelligent families. Citing others, Wing (1981) pointed out that "the antecedents for generations have been highly

intellectual" (Van Krevelen, 1971, p. 85). In light of Wing's findings, justification for identifying Asperger Syndrome as a separate entity was established in the third edition of the *Diagnostic and Statistical Manual* and for the years between 1994 and 2014, the condition of Asperger Syndrome was officially recognized by the APA.

But, researchers today are still in disagreement about whether or not there was actually any difference at all between the accounts of Kanner (1943) and Asperger (1944) or if the two accounts were simply continuums of the same disorder (Ozonoff, South, & Miller, 2000). By examining clinical notes from the archival records of the two clinicians, Gilbert (1996) found no significant difference in the clinician's descriptions of their cases. Hippler and Klicpera (2003) concurred in a study that analyzed all of the original case files of Hans Asperger and found that using DSM-IV criteria, only 68% of Asperger's patients met criteria for Asperger syndrome, while the rest demonstrated classical autism. Hippler and Klicpera (2003) added that of Asperger's 228 cases, only 57% had intellectual abilities that were well above average. Yet, because 68 of Asperger's cases still held original IQ test reports, with these, Hippler and Klicpera (2003) determined that the group mean for the Asperger cases suggested an IQ score of 116. No similar comparisons have been possible for the Kanner cases as IQ test reports were no longer in the files.

Over the years, as more and more researchers reviewed the accounts of Kanner (1943) and Asperger (1944) and considered them alongside the growing population of individuals with newly diagnosed autism and Asperger syndromes, Wing's (1981) differentiation became less clear. Also, as soon as the Asperger diagnosis gained favor as the very high functioning form of autism within an evidence-based body of literature that

was already riddled with changing definitions and terminologies, research during those years was further confounded by the fact that most often, those with autism were diagnosed when young, while those diagnosed with Asperger syndrome were identified later in life (Howlin & Asgharian, 1999). Silberman (2015) added an additional chapter to the Kanner/Asperger discussion when he recently discovered that the research associate of Kanner was the same person as that of Asperger. Silberman (2015), in his book *Neurotribes,* concluded that the populations of Kanner and Asperger were no different, though Kanner's work had prevailed because he was an American who was essentially immune to the effects of World War II. Because Silberman's work is not yet widely accepted, the debate about high- versus low-functioning autism and whether or not Asperger syndrome is a different condition than autism is still unsettled.

The Autistic Savant syndrome, often depicted for its "islands of genius amidst profound impairment" was first reported clinically in a scientific paper that appeared in Germany, where Mortiz (as cited in Treffert, 2009, p. 1) described the case of Jedediah Buxton who was "a lightning calculator with an extraordinary memory" (p. 1). Numerous reports of savant ability followed Mortiz's original report, but it wasn't until Kanner and Asperger produced their clinical accounts of autism that ASD became associated with the *savant syndrome* of the turn-of-the-century researchers. Even still, the researcher and early scientist Henry Cavendish, known for his social oddities and peculiarities as described by Jungnickela and McCormmach (as cited in Silberman, 2015) seemed to also fit the diagnostic picture for autism to this day, leaving many to wonder how many odd, yet brilliant scientists of years past fit the criteria.

During the early years of autism, while most clinicians focused on the severe impairments observed within the condition, nearly all early accounts also mentioned unexpected and highly advanced skills observed in some individuals with autism. Since the beginning, the conditions of autism have been closely associated with unusual savant abilities. According to Treffert (1999), 1 in 10 individuals with autism presents with clear savant ability. This curious aspect of autism has been widely portrayed in the media, particularly in recent years.

O'Connor and Hermelin (1989), two of the first researchers to seriously evaluate savant skills in ASD, examined prodigious talent, independent from IQ test scores and found that individuals with autism often shared a handful of prodigious abilities. Multiple O'Connor and Hermelin reports included findings on: (a) calendric calculations (1984); (b) reproducible, visual-memory (1987); (c) graphic and artistic copying abilities (1987); (d) musical abilities for both playing music and recognizing pitch (1987); and (e) the reading skills of efficiency and memorization (1994). In addition to documenting that savant skills actually exist and cannot be replicated in non-autistic populations, O'Connor and O'Connor and Hermelin (1989) concluded that "no one researching these curious abilities seriously questions that they can manifest where competence in most other areas of cognitive functioning is seriously impaired" (p. 109).

Miller (1998), interested in more of the *how* than the *what* of savant skill, compared the methods of problem solving in individuals with autism to those of typical children. In two separate studies, she found that while drawing tasks were usually completed in much the same way in ASD as they were for neuro-typical children (Miller, 1998), the cognitive problem-solving methods that those with autism used to perform

other savant tasks were very different and idiosyncratic (Miller, 1999). Miller also explored memory and concluded that individuals with autism almost always have some form of advanced memorization ability.

In more recent studies on savant abilities, Treffert (2005) focused on the origin and nature of the savant syndrome. Within his study, Treffert (2005) suggested that based on current findings about the condition of autism as viewed from the cognitive neurosciences, savant abilities could be identified as a "pathology of superiority" (p. 3), where compensatory growth in the right brain had resulted from impairment, injury, or high levels of testosterone in the developing left brain. Treffert (2005) confirmed Miller's (1998, 2001) continuum of savant skills, adding that all savant abilities are accompanied by some form of *prodigious memory*.

In spite of the general assumption that savant ability occurs only where severe impairment is also present, Heaton and Wallace (2004) clinically reviewed reports on the conditions of savant syndrome and concluded that while savant abilities are believed to occur as primarily *splinter skills* in individuals who are severely intellectually disabled, many of these same exceptional skills are also present as *high abilities* in ASD individuals with average or above intellectual functioning. The Heaton and Wallace (2004) review explored savant syndrome across cognitive ability levels and called for a change in focus about the condition to move away from circles of discussion on intelligence and, instead, toward talks about unique forms of cognition that have allowed those with ASD to develop these unique skill sets. Heaton and Wallace (2004) added a conclusion to suggest that savant skills are inextricably linked to a different and latent form of cognition in the autism condition. Donnelly and Altman (1994) shared similar

views in their examination of gifted students with ASD. Their report indicated that students with savant ability, irrespective of their intelligence levels, require adult mentors in their field of talent to convert *splinter skills* into usable savant talents.

In the 1990s, studies on latent potentials and savant abilities in autism essentially grew quiet under the blanket of high-functioning Asperger syndrome. During the years that followed the introduction of the Asperger syndrome label and within a field that was focused almost entirely on disability, according to Hart, Grigal, and Weir (2010), savant skills never again appeared within the literature, nor were they seriously considered within either the realm of latent potential or the discussions on high ability. A topic that was introduced during these years, however, was one of neurodiversity. Armstrong (2010) and, more recently, Silberman (2015) have both suggested that given the unusual talents and skills of so many individuals with autism, those who wish to understand the condition must first recognize that a different, but not necessarily disabled, form of cognition is at work for individuals along the autism spectrum.

Autism Spectrum Disorder and Giftedness

According to the National Education Association (2006), children with autism can also be gifted. With a term coined by Gallagher, *twice-exceptionality* made its formal appearance into the education-based literature shortly after Congress passed legislation to recognize needs for students who were gifted, but also required the support of special education services (Gallagher & Reis, 2004). With this, the introduction of students who were both gifted and on the spectrum of autism emerged. But according to Nicpon, Allmon, Sieck, and Stinson (2011), with changing definitions and competing theories between the fields of giftedness and ASD, to date, only a small number of studies have

considered the disability of ASD within giftedness. Even fewer have considered the topics of cognition and learning for gifted/ASD populations (Foley-Nicpon, Assouline, & Stinson, 2012).

Cash (1999), however, suggested that gifted learners with Asperger syndrome were making their way into programs for the gifted in numbers that were surprising. But in a study on educators' familiarity with the conditions of autism in the gifted, researchers found that because most were not that familiar with twice-exceptionality in the first place, fewer still recognized students on the autism spectrum as gifted (Nicpon, Doobay & Assouline, 2010). Foley-Nicpon, Assouline, and Stinson (2012) considered giftedness in ASD in a study that examined the IQ scores of 18 ASD/gifted students. The results suggested that significant discrepancies between very superior General Ability Index (GAI) scores were contrasted by average to low-average processing speed, working memory, and fine motor skills in GT/ASD groups. Nicpon et al. (2010) explored psychosocial functioning for 54 GT/ASD students, concluding that gifted students with ASD had more difficulties socially than other twice-exceptional groups. Huber (2007) added that different severity levels of difficulty for gifted students with autism spectrum disorders were directly related to their specific, differential diagnoses along the autism spectrum. Silverman (1997) and Lovecky (2003) furthered that because asynchronous development is an expected and normal part of being gifted, sorting disability from asynchrony for GT/ASD groups can be quite problematic.

Finally, because Terman (1931), one of the original thinkers on intelligence in the giftedness, equated giftedness with superiority, it has also taken a long time for society to recognize that individuals can even be both gifted and on the autism spectrum (Little,

Feng, VanTassel-Baska, Rogers, & Avery, 2007). As such, there is little to no information about the broad range of strength and weakness that is present or typical for those who are both gifted and diagnosed with ASD (Neihart, 2000).

With very few studies to consider on the topic of ASD in giftedness, the field of gifted education continues to suggest that at least 3-5% of all gifted individuals have one or more disabling characteristics (Nicpon et al., 2011). According to NEA (2006), there are approximately 360,000 children and adolescents in the U.S. who are identified as twice-exceptional, though it is not known what percentage of these individuals have ASD. More importantly, while the No Child Left Behind Act of 2001 recognized both giftedness and disability, changing definitions and terminology for the autism spectrum, along with challenges in identification have left many individuals who are both gifted and on the autism spectrum undiagnosed or misidentified (Nicpon et al., 2011). The most current educational legislation, the Every Student Succeeds Act of 2015, did not change the way students with ASD would be identified, but instead, gave the states more control over what they would be taught and how that teaching would be evaluated. In fact, the only point of divergence between the NCLB of 2001 and the Every Student Succeed Act of 2015 that might pertain to this inquiry is that one allows for only 10% of all children to be evaluated for academic success through the use of alternative assessments. Thus, unfortunately for those with the more severe effects of ASD (speech and motor challenges, for example) and in spite of their high ability in other areas, it appears that the challenges pertaining to identification for those ASD students who are highly asynchronous in their development will continue to remain unmet.

But, with much that is unclear about giftedness in ASD, what is certain is that more and more highly intelligent individuals diagnosed with the various conditions of autism are navigating their way into colleges and universities (Kaplan, 2011). Often presenting with very high cognitive ability and academic success through high school, many individuals with ASD are now finding post-secondary education an insurmountable hill to climb (Kaplan, 2011). Kaplan added that the majority of these individuals gain admission into vocational schools, colleges, and universities without ever identifying themselves as individuals with ASD. Shmulsky and Gobbo (2013) further suggested that these students tend to go unnoticed until their sensory, social, thinking, and learning style differences combine with poor executive functioning and fatigue, causing them to fail. Prince-Hughes (2002) concluded that much more needs to be done to recognize, understand, and support the growing number of individuals who are highly intelligent, yet struggling with the conditions of autism; despite good cognitive potential, society is losing these individuals.

Last in this section and on a rather controversial note, Burger-Veltmeijer, Minnaert, and Van Houten-Van den Bosch (2011) reported that ASD is found in higher-than-would-be-expected rates in gifted and twice-exceptional populations. Amend, Schuler, Beaver-Gavin, and Beights (2009) added that so many similarities exist between highly sensitive gifted children and gifted children with ASD that sorting the differences between the two is sometimes impossible. While studies on the topic of ASD in giftedness continue, there is still a paucity of information about the cross section of giftedness in ASD (Nicpon, Doobay, & Assouline, 2010).

Today's Autism Spectrum Disorder

In June of 2014, the DSM-V removed the Asperger syndrome diagnosis along with its identifying criteria, which placed all individuals with ASD on the same autism continuum. According to the APA, the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) revisions to the autism spectrum disorder were made to represent a new, more accurate, and scientifically useful way of consistently diagnosing individuals across clinics and treatment centers. Swedo et al. (2012) supported the APA's position and reported that DSM-5 criteria for ASD would better reflect the current state of knowledge about autism, particularly those findings that were emerging from the cognitive neurosciences. Using a single umbrella term, the APA believed that the rate of diagnosis would remain unchanged, and the majority of individuals previously diagnosed would still fall under the new term's diagnostic criteria.

Concerned about losing their diagnoses, however, many supporters of those with higher-functioning forms of autism did not agree with the change. Citing continuing reports of difference between autism and Asperger syndrome, Ghaziuddin (2010) proposed that Asperger syndrome remain in the DSM-5, with modifications to make diagnosing it clearer. Additional defenders of keeping the Asperger label claimed that narrowed definitions under the new term would keep the highest-functioning individuals with autism from receiving a diagnosis and from much-needed services. With this criticism in mind, for the first time in history, the international insurance billing system of ICD-10 did not adopt the DSM-5 change as it pertained to Asperger syndrome. Therefore, countries outside of the United States continue to diagnose Asperger syndrome for those who are highly verbal in spite of significant social impairments.

Using what is still an ongoing debate, many parents, educators, and professionals in the U.S. also continue to use the term Asperger syndrome to describe those individuals who are highly intelligent and have precocious language and/or advanced visual-spatial abilities as well as for those gifted *quirky* individuals who, in spite of their giftedness, have noticeable sensory, social, or pragmatic language difficulties.

Intelligence and its Measurement

The common and currently accepted formal notion of intelligence is that there is a specific and relatively independent group of brain functions (Spearman, 1904) that have the ability to predict cognitive potential and academic achievement (Alloway & Alloway, 2013) and, thereby, to dictate occupational success (Ryan et al., 1992). But as the changing times and technologies of the past two decades have moved society into the *information age*, reliance on Spearman's (1904) primary construct for intelligence in the 21st Century might no longer be appropriate according to Armstrong (2010). This realization is thought to be especially true for individuals for whom sensory and/or cognitive style differences slow reaction times (Deary, Der, & Ford, 2001). In autism, in particular, it has been suspected that both cognitive learning style differences and sensory challenges might have a detrimental effect on IQ test scores. But, until one understands intelligence as it has been formally described over the past century and a background in the traditional construct of intelligence is established, understanding how those with autism might be affected by the modern-day construct of intelligence isn't possible. Therefore, the following sections detail both the evolution and assessment issues in testing for IQ in the general population and those topics of research on intelligence and its assessment in ASD.

The Construct of Intelligence

As it is still formally defined today, the construct of intelligence purports that a general factor of intelligence or *G* factor, as originally proposed by Charles Spearman in 1904 and furthered through factor analysis, is an underlying trait that runs in families, carries forward genetically, can be accurately estimated through IQ test scores, and predicts academic and occupational success (Posthuma et al., 2002). Spearman (1904) explained that *G* in the normal course of events is determined innately; in other words, "a person can no more be trained to have it in a higher degree than he can be trained to be taller" (p. 157). But, when specifically asked to explain what general intelligence was, not even Spearman could accurately describe it. Accordingly, Spearman (1904) stated

> G appears to measure some form of mental energy. . . . G behaves as if it measured an energy . . . there seems to be good reason for changing the concept of energy to that of "power" (which, of course, is energy or work divided by time). In this way, one can talk about mind power in much the same manner as about horse power. (as cited in Jensen, 2000, p. 106)

With Spearman's work at its foundation, research on the construct of intelligence has furthered the belief that IQ scores predict intelligence, are stable across different periods in cognitive development, and are consistent across a variety of instruments designed to measure them (Tucker-Drob, 2009). According to Wechsler (2003), an individual's intellectual quotient (IQ) test scores assess cognitive functioning and provide valid numbers that represent one's overall "general intellectual ability" (p. 1).

But, no discussion on intelligence is complete without an understanding about how the constructs for IQ, beyond Spearman's original proposal, were first established. In 1904, Charles Spearman put forth his theory about intelligence by testing a number of children using testing instruments that were available at that time. During these early

years, Spearman was only one of a dozen or more theorists to propose a construct for what intelligence actually was. At that time, there was considerable debate about what intelligence actually was. Then, with a revolutionary twist, Spearman mathematically *invented* factor analysis to process the data, which pushed his construct to the forefront above all of the others. This led to a bi-factor solution, whereby a fairly large (40%) portion of the data were accounted for in the first factor (the G Factor), and several, smaller variables were combined into a second factor (Carroll, 1993). Spearman (1904) concluded that the first factor in intelligence was essentially a form of general intelligence that could be demonstrated through language (this accounted for about 40% of the data), and the second factor was the combination of several different performance-type abilities (explaining another 10%-15%). Spearman's best bi-factors solution left over 40% of the IQ construct data unexplained, which by today's standards would not be considered a great model; but according to Carroll (1993), because Spearman's bi-factor theory was the only one that could be further analyzed mathematically, it became the dominant theory of its time and the leading theory that has carried forward to today's definition.

However, according to some, the theory might not have even been correct. In the late 1930s and early 1940s, researchers Holzinger and Swineford (1942) set out to test Spearman's (1904) bi-factor intelligence theory. To do this, they evaluated a large number of students from three different schools using intelligence test components either already in use or constructed (28 tests in all) for the study in the Holzinger-Swineford Lab. Then, Holzinger and Swineford (1942) performed what was essentially a hand-calculated factor analysis procedure on their data to support both the stability and the

reliability of Spearman's (1904) bi-factor theory on intelligence. Their findings supported Spearman, although critics pointed to their close association with Spearman as confounding variables in their research (Sternberg & Wagner, 1993). Sternberg and Wagner (1993) furthered that Spearman's *g-ocentric* view of intelligence, especially as it related vocational success, was simply wrong. But, with Spearman's bi-factor confirmed by Holzinger and Swineford (1942), the construct of intelligence became widely accepted; even though years later when computing could be done by machine, that Spearman construct for intelligence was brought back into question.

In computer re-analysis of the Holzinger-Swineford (1942) data (most with the intention of either verifying or refuting Spearman's original factors) and using modern and rigorous statistical methodologies, researchers have since consistently found significant problems within the original data set produced by Holzinger and Swineford and with the factor original analyses procedures employed by both Spearman and by Holzinger and Swineford (Carroll, 1993). According to Carroll (1993), first, two of the three schools from which the data were collected and used for comparison were not similar enough to meet basic assumptions for factor analysis; one of the schools and nearly half of the data used in the IQ construct were comprised of primarily first-generation immigrants whose children spoke a different language at home than at school. Second, problems with outliers marked the data set as unusable, based on current standards for factor analytic procedures (Tabachnick & Fidell, 2013). Last, the factor analysis procedure itself, as proposed by Spearman (1904) and confirmed by Holzinger and Swineford (1942), was able to account for only just under half of the data, using Spearman's two-factor model. The addition of extra factors (which were combined

within Spearman's second bi-factor) only slightly improved the variability explanation, leaving nearly half of the Holzinger-Swineford IQ data unexplained. These problems never made it to the mainstream, however, because by the time Spearman's construct was put to the test mathematically using computer calculations, it was no longer questioned. Therefore, in spite of these issues, intelligence and its assumed ability to predict cognition as measured today within the construct of Spearman's bi-factor intelligence theory still remains essentially undisputed.

In spite of questionable assumptions about what the tests purport to measure, IQ tests are standardized across a large sample of randomly selected individuals, and the scores that the tests produce are then reported as standard scores and percentiles, with ranges that are possible from the very superior/gifted ranges into the ranges of intellectually disability. Distributed *normally*, the scores most often carry a mean of 100 and a standard deviation of 15, although some tests use a different scale. Thus, for the majority of IQ tests in use today, scores between 85 and 115 are considered to be average (Weschler, 2003). In special populations as well as in the general population, intelligence scores are heavily relied upon to predict cognitive potential and to guide educational planning towards vocational outcomes (Mercer, Jordan, Allsopp, & Mercer, 1996). This is true for both the middle of the distribution as well the high and low ends or *tails* of the distribution (Einfeld & Tonge, 1996; Treffinger & Renzulli, 1986).

The Tails of the Standard Distribution

At the top of the standard distribution of IQ tests, under current constructs for intelligence, test scores formally define those who are intellectually gifted by using the term *highly superior*, whereby test scores (assuming a standard score with a mean of 100

and a standard deviation of 15) indicate intellectual giftedness for those who score above 130. Using the same IQ construct and assumptions, *intellectual disability* is the current term used for those individuals with IQ Standard Scores that fall below 70 (Schalock, Luckasson, & Shogren, 2007). Of particular relevance to this inquiry, it should be noted that the IQ score definition of intellectual giftedness does not match the one recognized by the field of gifted education (see definition of gifted), but this standard deviation definition is rarely disputed for those with intellectual disability.

But, not all gifted or intellectually disabled individuals have consistent skill development. For example, an individual can be intellectually gifted, based on the averaging of their scores, even though some of their scores are at the bottom of the IQ standard distribution; or, an intellectually disabled individual might have very low overall average IQ scores, but can show strength areas that are much higher, into the normal or even the gifted ranges of functioning (Sattler, 1988). From this cognitive perspective, twice-exceptionality exists when the overall IQ scores indicate giftedness, but there is also a significant area of disability (Assouline & Whiteman, 2011). For those individuals with overall or *averaged* IQ scores that are in the intellectually disabled range, strength areas, even if they are in the gifted range of functioning, are most frequently called splinter skills (DeMyer et al.,1974).

While a standard distribution of scores must be assumed for the scores to be valid, according to Micceri (1989), the farther one is from the center of the normal distribution, above or below the mean, the more pronounced is the scatter of their scores. Micceri added that a truly normal distribution is about as common as a unicorn because scores at the tail ends of the distribution are significantly less reliable and stable. On the high end

of the IQ spectrum, Cahan & Gejman (1993) found that while performance IQ generally remains constant in children who are gifted, verbal IQ scores frequently decrease between the ages of 6 and 12. On the bottom end of the distribution for those with intellectual disabilities, according to Mayes and Calhoun (2003), IQ scores have the tendency to increase significantly over the life span. Significant score scatter is reported for both gifted and intellectually disabled groups; this is especially true in certain populations such as those who are twice-exceptional and those diagnosed with ASD.

Problems with Intelligence Quotient Tests

Although IQ scores are believed to accurately depict innate intellectual abilities, it is also widely accepted that a variety of factors can negatively affect the scores. Researchers cite temperament (Colom et al., 2007), motivation (Preckel et al., 2006), language processing deficits (Bartak & Rutter 1976), and motor planning issues (Manjiviona & Prior, 1999) as causes for lower IQ scores. Helms (1992), Flynn (1987), and Sternberg et al. (2001) also reported that IQ scores are culturally dependent. Micceri (1989) added that the standard bell curve on most IQ tests is not normally distributed.

Kanaya et al. (2003) reported that issues with IQ tests yield inaccurate scores at both of the tail ends of the standard distribution (two-standardization from the mean). According to their findings, inclusion rates with each new version of an IQ test moves those individuals with disabilities or giftedness closer together to *normalize* what is actually a naturally wider difference between the highest and the lowest scores. In his book, *What is Intelligence?: Beyond the Flynn Effect,* Flynn (2007) also suggested that IQ scores are not stable and have risen dramatically in the years since Spearman (1904) originally proposed the construct. Flynn was the first researcher in many decades to

question the construct of intelligence, and critics since have mostly dismissed Flynn's position (Wicherts, et al., 2004).

Intelligence in Autism Spectrum Disorder

In the autism literature, intellectual ability has also been discussed primarily in terms of IQ scores. While it is assumed that individuals with autism can have varying degrees of intelligence, it is still widely held that 75% of individuals with autism have intellectual disabilities (Larson et al., 2001; McMahon & Ritvo, 1989) with IQ scores below 70. As one of the primary issues being addressed in this research, the following topics, as they are presented in the literature, give detail and provide a foundation for understanding about intelligence and its measurement for those with ASD.

Autism-Asperger Comparisons Studies

Through the years as changing definitions of autism began to consider Asperger syndrome, views on intelligence in autism shifted slightly, and researchers became interested in comparing intelligence between what was then viewed to be two disparate groups, those with classical autism and those with Asperger syndrome. With that focus, unfortunately, almost all of the research on intelligence during the *Asperger years* focused on Asperger-autism IQ differences. Within these, it was suggested that peaks on tasks of visual perception were common in autism, while higher-level verbal comprehension was more the norm for those with Asperger syndrome (Ehlers et al., 1997; Lincoln, Courchesne, Kilman, Elmasian, & Allen, 1988). These studies were criticized, however, for again using an older definition of autism, which according to Ehlers et al. (1997) led to false reports of higher IQ overall intelligence in the Asperger syndrome groups.

Using DSM-IV's (1994) Asperger-autism criteria, Miller and Ozonoff (2000) examined intelligence in a study that matched the two populations, comparing them on intellectual and neurocognitive processing abilities. Their study found significant visual and motor delays in both Asperger syndrome and autism, but no clinically significant differences between the cognitive profiles of the two groups. Contradicting current views on diagnostic difference between autism and Asperger syndrome, the Miller and Ozonoff (2000) study concluded that Asperger syndrome was simply a higher-functioning version of autism.

Also under DSM-IV's (1994) Asperger diagnostic procedures, Charman et al. (2011) re-opened the topic of the validity of IQ testing in autism to question assumptions about intellectual disabilities and to challenge whether or not a characteristic verbal/perceptual IQ profile difference was present in autism and/or Asperger syndrome. In their study, evidence for an overall higher performance IQ versus lower verbal IQ was found, but a specific verbal/performance skillset difference was not identified in either autism or Asperger syndrome.

Changing Rates of Intellectual Disability in Autism Spectrum Disorder

To explore whether or not the rates of intellectual disability were changing across the continuum of autism in recent years, Charman et al. (2011) concluded that only 55% of a large sample of individuals with traditional autism showed intellectual disabilities; of these, only 16% scored in the moderate to severe intellectual disability range. This finding was unexpected, as previous IQ studies in autism had shown a much higher incidence of more-severe impairment. The Charman et al. (2011) study concluded by suggesting that autism, even in the more classical and severe form, is less strongly

associated with intellectual disability than researchers had previously believed. But since, the topic has not been re-considered, and the work of Charmen et al. (2011) remains largely unreported.

Autism Spectrum Disorder and Giftedness

In gifted groups, Foley-Nicpon et al. (2012) specifically examined cognitive differences for individuals with very high-functioning autism (measured IQ scores above 120). In their study, Foley-Nicpon et al. (2012) matched a group of gifted children with autism, based on their IQ scores, to a similar group diagnosed with Asperger syndrome. The researchers concurred with previous studies, that higher verbal comprehension abilities are present for the Asperger group. Unlike previous studies, however, Foley-Nicpon et al. (2012) also found higher math fluency and visual-motor processing in their gifted autism group. This led to the conclusion that while those with autism scored higher on perceptual tasks, those with Asperger syndrome outperformed in the verbal domain when IQ scores were in the superior and gifted ranges.

Intelligence Quotient Validity in Autism Spectrum Disorder

Even though the majority of those with ASD are believed to be intellectually disabled, numerous studies have called into question the validity of using IQ tests to predict cognitive functioning for those on the autism spectrum. For example, it is reported that the measurement of intelligence is known to be negatively affected by difficulties with language processing and visual-motor function for individuals with ASD (Bartak & Rutter, 1976; Manjiviona & Prior, 1999; Provost, 2007). Providing more specific detail, several researchers have reported that impairment in ocular-motor and

visual-motor processing skill as well as visual-motor and motor planning difficulties negatively affects IQ scores for individuals on the spectrum of autism (Hippler & Klicpera, 2003; Scharre & Creedon, 1992; Weimer et al., 2001). Not surprising, given heavy weighting towards fast visual and visual-motor processing, Scheuffgen et al. (2000) also found that the processing speed was, in general, significantly lower for the majority of ASD children. Facon (2008) and Lord et al. (1989) added that while IQ is reportedly stable throughout the lifespan for most individuals, as language and visual-motor skills mature, the scores for those on the autism spectrum improve dramatically.

Drawing on previous findings, but using the ASD umbrella term for the entire autism spectrum, Rao and Ashok (2013) re-opened the IQ question in autism and highlighted numerous difficulties in determining IQ in the presence of ASD. Based on their efforts to evaluate children and combined with qualitative observations about testing procedures, Rao and Ashok concluded that the use of standardized intelligence tests in ASD is essentially not very meaningful, based on limitations in verbal communication, problems with social interaction, and associated problems in autism (such as hypersensitivity or visual-motor difficulties). They suggested that those with ASD frequently obtain a wide scatter of scores, which indicates that the measures are not valid as overall indicators of potential. Rao and Ashok (2013) added that difficulties in adhering to prescribed time limits and standardized instructions for the tests, when used with ASD populations, raises serious questions about the accuracy of the IQ scores obtained for all individuals with ASD.

Using the new DSM-5 criteria for identification, Bodner, Williams, Engelhardt, and Bodner et al. (2014) compared several different IQ measures to assess the level and

nature of intelligence in verbal children and adults with ASD. Their report claimed that standardized intelligence tests are riddled with contention due to difficulties in communication that lead to misunderstood directions, inaccurate responding, refusal or failure to respond, the need for non-standard prompts, and/or a lack of skill and knowledge on the part of those giving the tests about testing procedures for individuals with ASD. Citing previous works that supported the use of the Ravens Progressive Matrices (a test of nonverbal intelligence), Bodner et al. (2014) added that certain tests, when compared to others that are supposed to yield high test, re-test reliability, yield score differences of 30%-70% for those with ASD. Bodner et al. (2014) concluded that there appear to be no valid measures available to assess global cognitive functioning for individuals with ASD. Based on their findings (2014), it was suggested that more reliable and flexible means of assessing cognitive functioning for individuals with ASD must be explored before the intelligence discussion on potential in ASD could ever be settled.

Cognition

Best defined as "all our mental abilities" (Glass & Holyoak, 1986), the assumption is made that IQ scores accurately capture and predict at least some of the more important of the cognitive abilities that pertain to learning and, therefore, that success in adult life is assumed and prevalent throughout the research-based literature. But within the literature, there are also countless reports and speculations on the existence of cognitive differences and many of these have resulted in highly successful adult functioning (Sternberg & Wagner, 1993). In ASD, specifically, the literature is quite clear that cognitive differences exist, but the literature lacks agreement on a universal

pattern of cognitive difference across all of those with ASD. This has led to differing opinions about how ASD actually affects cognition and about how cognition can be predicted for those with ASD. Some of the cognitive difference theories that have emerged through the years have focused primarily on cognitive deficits in ASD, although the more recent cognitive theories in ASD have promoted a strength-based explanation for cognitive difference. For all of these reasons, the literature review on the topic of cognition, as it is proposed for a topic of inclusion in this study, begins with a broad overview of cognition in general, then highlights the primary cognitive difference theories that have emerged in the ASD research through the years.

Cognition Historically Defined

Buzan and Buzan (1993) suggested that with over 100 billion brain cells simultaneously connecting to tens of thousuands of other cells, human cognition is simply too complex to even begin to understand. Sir Charles Sherrington, the grandfather of modern-day neurophysiology agreed. He described the cognitive process as "an enchanted loom where millions of flashing shuttles weave a pattern, always meaningful though never abiding . . . as if the Milky Way had entered in upon itself in some cosmic dance" (Sherrington, as cited in Hansotia, 2003, p. 329).

Thus, with a preface on this subject suggesting that cognition might not be properly understood or detailed within this review, an even rudimentary discussion about cognition, as it is tied to intelligence and learning, must certainly include an introduction into both the behavioral and cognitive influences in psychology and education because it is within these lenses that our human understanding about cognition has primarily been understood and explained (Collins, Greeno, Resnick, Berliner, & Calfee, 1992).

Gazzaniga (2004) added that because the cognitive neurosciences are also beginning to have a significant impact on our understanding about the biology of thinking and learning, this field, too, must be included in any serious discussion about the construct of cognition.

Behaviorism

In what appears to be the first evidence-based research to formally explore higher cognitive processes in learning, Ebbinghaus (1913) carefully studied memory using a systematic and replicated methodology. Within a focus that was both developmental and ontogenetic following Ebbinghaus' landmark work, research on cognition in the first half of the 20th century was dominated by the behavioral traditions of Watson (1925) and Skinner (1953). In behaviorism, under the conception that children come into the world as blank slates, the primary view on learning and, thereby, cognition was that through operant conditioning, learning occurred as individuals adapted to the environment around them.

In the early behaviorist tradition (often using animals as subjects), training or teaching was understood to be the necessary method that improved performance on simple, often rote tasks that could be observed, then reinforced (Baum, 2005). Described as a continuous interplay between action and interaction, Skinner's (1953) behaviorism implied that all learning was capable of being measured through observation of the actions or products that resulted when a specific teaching or training sequence was employed.

Cognitive Psychology

With criticism that behaviorism provided too narrow a view on cognition, early cognitive learning theorists shifted their thinking to consider those topics in learning that were more complex (and less easy to observe). For example, verbal learning (Ausubel, 1977), the use of visual imagery in learning (Paivio, 1976), learning through active discovery (Bruner,1961), generative learning (Wittrock, 1974), and language mnemonics (Bower, 1970) became the first of several new and emerging research topics for the field of the early cognitive psychologists.

Soon after their inception though, cognitive learning traditions also began to draw heavily from the systems and processing theories that were emerging from the field of computer science at that time (Pinker, 1979). This quickly led to the assumption that the brain was like a computer. Within this expansion of the cognitive learning tradition, theorists surmised that cognition came from the brain-as-object, and was, therefore, capable of being understood through dissection and dissemination. In this world-view, the brain could also be analyzed through the examination of its hemisphere lobes, structures, and systems of processing (Shettleworth, 1999). Ideas and theories such as Paivio's (1991) dual coding theory, the *top-down versus bottom-up* research on learning and attention, as proposed by Sarter, Givens, and Bruno (2001), and Deci, Vallerand, Pelletier, and Ryan's (1991) work on self-determinism became leading areas of research that were, in short order, applied to the classroom. Like behaviorism, though, very little has changed in this field since; although in recent years, within the cognitive learning tradition, research has expanded somewhat to further explore the roles of experience in learning (Boud, Keogh, & Walker, 2013).

Critics of the various cognitive learning theories emerged early, however. Voss (1978) stated that "although the concept of learning may be found in cognitive psychology, it also must be conceded that the cognitive view of learning is vague, is abstract, and, most important, is lacking a substantive data base" (p. 13). To address Voss' missing data in the cognitive learning tradition over the years, the traditions of behaviorism and cognitive learning theory merged within a combined, cognitive-behavioral tradition in "a purposeful attempt to preserve the demonstrated efficiencies of behavior modification within a less doctrinaire context to incorporate cognitive activities" (Kendall & Hollon, 2013, p. 1).

In the past decade in particular, the two traditions have also joined with the cognitive neuro-sciences, where high-level information-processing simulations and advanced medical equipment have attempted to take into account a variety of neurobiological elements in information processing and learning. Like behaviorism and cognitive learning theory, though, much of what researchers explored in the early days of the cognitive neuro-sciences continues to drive research endeavors today (Baum, 2005). Baum added that nearly all of what is understood about cognition still comes out of either the behavioral or the cognitive learning tradition.

This continuing influence is especially evident in today's schools, where emphasis on the measurement of standardized, academic outcomes, and observable behaviors have been paramount within the No Child Left Behind Act of 2001. According Guilfoyle (2006), the current failures of schools within the No Child Left Behind Act of 2001 stem from over-reliance on narrow and even outdated views on cognition and learning within the developmental world-views of the behaviorists and the cognitive

learning theorists. According to Domjan (2014), learning continues to be defined as "an enduring change in the mechanism of behavior involving specific stimuli/and or responses that results from prior experience with those or similar stimuli and responses" (p. 14). As such, cognition is still primarily understood as either an experimental or a systems-based process that relates primarily to the specific memorization, recall, and written production tasks of the past century (Baum, 2005). Because of this limited view on cognition, educators today still have a long way to go before behaviors and standards-based assessments can fully capture deeply authentic forms of cognition and apply these to learning (Rao & Ashok, 2013). The Every Student Succeeds Act of 2015 released some control of standards, particularly as they apply to curriculum and measurement of success away from a national stronghold and back into the hands of the states, but otherwise, very little has been done to change the view of cognition and learning in the past decade.

Neurobiology on Cognition

With heavy ties to behaviorism and the cognitive learning theory traditions (Baum, 2005), Nichols and Newsome (1999) reported "the deepest mysteries facing the natural sciences today concern the higher functions of the central nervous system . . . understanding how the brain gives rise to mental experience looms as one of the central challenges for science in the new millennium" (p. c35). With this objective, using technical innovations that include functional magnetic resonance imaging, positron emission tomography, evoked potentials, magnetoencephalography, multi-electrode recording, and high resolution charged-coupled device (CCD) imaging within a reductionist paradigm has allowed researchers to begin to more deeply explore the brain

and, thus, cognition to improve understanding about intelligence and learning (Cabeza & Kingstone, 2006). Using these technologies, a number of computational theories about cognition have been hypothesized, although none seriously debated. According to O'Reilly and Munakata (2000), it is believed that one day soon, cognition will be fully understood through advances in neurobiology that are combined with high-level computer-generated brain simulations.

Though it is impossible to even scratch the surface about this field in a brief paragraph or two, some of the more interesting and technical topics that are pertinent to this review include studies on the understanding of consciousness within the role of experience (Solms & Turnbull, 2002) and the effects of decision-making and determinism on thinking and learning. Yet, with all that is known, Werner (2007), a prominent neurobiologists and medical doctor at the University of Texas, reported that

> Much of current neurophysiology is infested with misconceptions and faulty styles of reasoning . . . worse still, very often, it does not heed its own most important accomplishment: that the brain must be understood as a complex system, responding and acting at any time as a whole. (p. 20)

Cognition in Autism Spectrum Disorder

Through the years and in alignment with behaviorism, the cognitive learning theory movement, and more recently within the field of neurobiology, a number of rollercoaster theories about the causes of autism have quickly arisen, gained nearly universal momentum, then fallen just as abruptly into utter disregard. Perhaps one of the more famous of these was Bettleheim's (1967) theory set forth in his book, *The Empty Fortress*. In this work with its foundation in behaviorisms' views on the development of human cognition, Bettleheim claimed that emotionless and absent parenting caused autism. Researchers today look back and laugh at the ridiculousness of their

predecessors; yet, in recent years, the vaccination debate forwarded within the field of neurobiology has followed a similar and frenzied pattern of ups and downs (Madsen et al., 2002), such that anyone who now continues to claim that vaccinations cause autism is quickly dismissed as uneducated, even though thousands of parents annually continue to report witnessing their neuro-typical children regress into autism following multiple, same-day vaccinations (National Vaccine Information Center, 2015). Within today's theory, leading research trends report that environmental toxicity combined with genetic predisposition causes autism (Herbert, 2005). But within all of these causality theories a lesson emerges that applies to the discussion about cognitive difference in ASD; namely, the spectrum of autism is just as confusing to researchers in this period of time as it was over 70 years ago.

Over the years, while Bettleheim (1967) and others theorized about why autism occurred, just as much guesswork has been applied to the study of cognitive difference within the disorder. Within this body of research, as has been true with the causality theories, both fact and folly continue to emerge while contradictions abound (Wellman, Cross, & Watson, 2001).

Applied Behavior Analysis and Skill Specific Research

Perhaps the first clinical researchers to consider cognitive difference in ASD, at least from a broad theoretical construct, were Lovaas, Schaeffer, and Simmons (1965). In their work, Lovaas et al. (1965) used operant conditioning models that included the application of electric shock, borrowed from the behaviorist of their time (Skinner, 1953), to teach language, communication, and the behavioral skills of attending. Lovaas, Koegel, and Simmons (1973) reported improvement in both intellectual functioning and

behavior. In one of the most prominent meta-analyses of applied behavior analysis (ABA) since, covering all of the published studies across a number of different Lovaas-type methods to date, it was confirmed that both intelligence and adaptive behavior improved significantly when ABA therapy was the primary intervention (Eldevik et al., 2009). This study, along with numerous replications has led researchers and educators to conclude that early, intensive behavioral intervention should be the intervention of choice for all children with ASD (Eldevik et al. 2009).

While attending, communicating, and behavior were the primary foci of the early behaviorists, over the years, studies within cognitive learning suggested that latent, yet prevailing cognitive differences existed for individuals with autism. With this assumption, the field of cognitive psychology identified countless specific deficits in the condition. For example Hermelin and O'Connor (1967) found unusual strengths in the verbal memory of those with autism (more specifically, auditory memory was found to be better than visual memory for many individuals with autism). This was confirmed by Hermelin and O'Connor (1970) as well as Prior (1979). In another deficit-specific study, Frith (1970) suggested that problems with perception stemmed from differences in selective attention. Prior (1979) also suggested the presence of under- and over-sensitivity (to both visual and auditory stimuli) in autism. Tager-Flusberg (1991) and Bowler, Matthews, and Gardiner (1997) proposed that within autism, altered categorization skills improve verbal and visual memory recall in autism. Other studies explored attention (Mann & Walker, 2003).

Cognitive Difference Theories in Autism Spectrum Disorder

As the years passed, all of the theories about individual difference (primarily the deficits) in autism seemed to be heavily dependent on the specific demands of the tasks, which led to inconsistent findings and the need for a broader and more inclusive theory about cognition in autism (Rajendran & Mitchell, 2007). With that goal in mind, in the tradition of cognitive psychology, researchers explored several higher-level processing differences in autism in an effort to put forth a theory that would be universal, specific, and unique to the autism spectrum. Three primary, cognitive theories in ASD subsequently evolved.

Theory of mind—mind blindness theory. In what is likely the most widely researched of all cognition topics in autism, Frith and Happe (1994) put forth the first of the cognitive processing theories in autism with their Theory of Mind or *mind blindness theory*. This theory suggested that individuals with autism failed to "impute mental states to themselves and others" (Premack & Woodruff, 1978, p. 515) and that, as a result, these deficits manifested socially. Using tests like the *Unexpected Transfer Test of False Belief* (Wimmer & Perner, 1983), *The Deceptive Box Test* (Perner, Frith, Leslie, & Leekam, (1989), *The Eyes Task* (Baron-Cohen et al., 1997), and *The Strange Stories Test*, researchers argued (often with contradictory findings and for over a decade) about whether or not individuals with ASD had a *theory of mind*.

As one of the more interesting accounts within the mind-blindness debate (one that ascribed inherent social differences in ASD to mind blindness), Klin (2000) gave the following account to describe reporting about the movement of several basic geometric shapes. Within this study, the neuro-typical child responded:

> What happened was that the larger triangle—which was like a bigger kid or bully—had isolated himself from everything else until two new kids come along and the little one was a bit more shy, scared, and the smaller triangle more like stood up for himself and protected the little one. (p. 840)

In contrast, Klin (2000) found that those with autism more typically responded with the following:

> The big triangle went into the rectangle. There were a small triangle and a circle. The big triangle went out. The shapes bounce off each other. The small circle went inside the rectangle. The big triangle was in the box with the circle. Then the small triangle and the circle went around each other a few times. (Klin, 2000, p. 840)

Klin (2000) attributed these differences to inherent social generalizations that occur normally in neuro-typical children, but are not present in those on the spectrum of autism.

Some of the leading arguments surrounding *theory of mind* or *mind blindness* included: (a) Baron-Cohen, Leslie and Frith's (1985) support for the original theory, based on an 80% failure rate in autism using the *Unexpected Transfer Test*; (b) Happe's (1994) finding that the theory was not universal; (c) Baron-Cohen's (1989) suggestion that the deficits supported within the theory were caused by a delay in responding, rather than a true deficit; and (d) Bowler's (1992) challenge that the theory was, at best, a *folk theory*. In the end, although still disputed to this day, with results that were not ideal for arguing that autism is devoid of a theory of mind and, therefore, not a domain-specific deficit (Baron-Cohen et al., 1997), researchers Ozonoff, Pennington, and Rogers (1991) looked to a different explanation for cognitive difference in the autism continuum.

Disorder of executive functioning theory. A second theory (and one that is still gaining momentum) is the disorder of executive functioning theory (Ozonoff, Pennington, & Rogers 1991). Drawing from theories on dysexecutive syndrome (Wilson, Alderman, Burgess, Emslie, & Evans, 2003) as it was observed in individuals with

traumatic brain injuries, according to Ozonoff et al. (1991), those with ASD have specific frontal lobe damage that explains their need for sameness, their difficulty in switching attention, their tendency to perseverate, and their lack of impulse control. Ozonoff (1995) defined executive functioning as:

> The cognitive construct used to describe goal-directed, future-oriented behaviors thought to be mediated by the frontal lobes [Duncan 1986], including planning, inhibition of pre-potent responses, flexibility, organized search, self-monitoring, and use of working memory" (p.185).

To assess executive functioning, researchers have since examined the skills of inhibition, intentionality, and executive memory in those with ASD using tests such as the *Stroop Test* (Stroop, 1935), the *Behavioral Assessment of the Dysexecutive Syndrome* (Wilson, Alderman, Burgess, Emslie, & Evans, 2003), and the *Tower of London Test* (Norman & Shallice, 1986). Results on tests of executive functioning have been mixed for individuals with ASD. In the original studies on executive functioning, Ozonoff, Pennington, and Rogers (1991) found that 96% of those with autism performed less well on tasks of executive functioning than those in a matched control group. But, with the intent of replicating the findings of Ozonoff et al. (1991), Pellicano, Maybery, Durkin, and Maley (2006) reported that executive functioning deficits were found in only approximately 50% of their sample. In reply, Ozonoff and Strayer (1997) put forth new findings to conclude that unlike other learning or behavior disorders, those with autism or Asperger syndrome show a specific deficit in cognitive flexibility, even though inhibition, which is poor in other groups with executive function difficulty, remains unaffected in the continuums of autism.

Other studies openly criticized the executive functioning theory stating that the deficits identified within executive functioning, while shared across several behavior and

learning conditions, do not suggest a pattern of deficit that is specific for those with ASD (Sergeant, Geurts, & Oosterlaan, 2002).

With findings that are still inconsistent, yet show promise for explaining certain aspects of executive functioning deficits in ASD, some called for a hybrid theory between executive functioning theory and theory of mind (Hala & Russell, 2001). Because (as it was argued) executive functioning is central to theory of mind (Hala & Russsell, 2001), hybrid theories including the cognitive complexity theory and the control theory (Frye et al., 1995; Zelazo & Frye, 1997) were suggested. These blended approaches focused primarily on deficits in higher order rule use, which suggested that combined executive functioning and mind blindness deficits tied closely to the condition of ASD (Frye, 1998). In their review across the entire topic of executive functioning theory in ASD, Hill and Bird (2006) concluded that the theory did not provide a consistent argument for executive function as a core feature in ASD although various components within the executive functioning theory are clearly impaired for many individuals with ASD.

Weak central coherence theory. Still striving to find a cognitive processing difference theory that more fully explained ASD, a third cognitive theory, the weak central coherence theory, was proposed by Happé, Briskman, and Frith (2001). With deficits as the primary focus for the other two theories based on their observations that ASD individuals exhibit strong, repetitive behaviors and prefer sameness, Happé et al. (2001) proposed their weak central coherence theory to explain a different cognitive processing style whereby local versus global reasoning were marked as strengths within the condition of ASD. The theory was tested by measuring performance on tasks such as the *Embedded Figures Task* or Wechsler's *Block Design subtest*, under the assumption

that these tasks predicted performance for abstract visual reasoning, segmentation, and attention to detail (Sattler, 2008).

Those who supported the weak central coherence theory explained that in ASD, the skill of *systemizing*, described elsewhere as visual sequencing, logic, and whole-to-part visual processing, especially when present as a global area of strength, was predominant in many ASD individuals (Frith & Happé , 1994). Feeling that the weak central coherence theory might have focused too heavily on cognitive, strength-based differences in ASD while failing to identify the challenges that were suggested through theory of mind (primarily that of empathizing), Happé et al. (2001) eventually combined the two theories to put forth their empathising-systemising theory which combined strength areas in visual and cognitive processing differences, but added a component of deficit for empathizing.

Fombonne, Bolton, Prior, Jordan, and Rutter (1997) also supported a hyper-systemizing theory in their large family study on individuals with ASD. Fombonne et al. found that the cognitive patterns of systemizing also frequently occurred in the parents and siblings of those on the spectrum, but for many, the skills had lent themselves to successes in the fields of science, technology, engineering, and mathematics (STEM).

Other strength-based and hyper-systemizing theories. Also drawing on strength-based cognitive differences as proposed within the weak central coherence theory and taking into account research on sensory differences in ASD, Baron-Cohen et al. (2007) recently suggested one of the newest emerging theories on cognitive difference in ASD. Within Baron-Cohen et al.'s (2007) hyper-systemizing theory, researchers became the first of all of the cognitive learning theorists to both formally question

underlying intelligence in ASD and to suggest that in spite of the widely held world-view that ASD is often accompanied by intellectual disability, ASD instead occurs in children who are highly intelligent, yet due to their sensory processing differences, are unable to sort, filter, and/or select a single set of information that then *freezes* all other information processing. Markram, Rinaldi, and Markram (2007) agreed with Baron-Cohen et al. (2007), proposing an alternative title for their version of the theory called *the intense world syndrome theory*. The Markram et al. (2007) theory, like the Baron-Cohen et al. (2007) theory, essentially assumes that high intelligence, which is equated with taking in too much sensory information, causes cognitive processing systems to come to a halt for those with ASD. As a relatively new theory, much of what has been researched on the Baron-Cohen et al. (2007) theory and the Markram et al. (2007) theory are beginning to undergo further exploration within the cognitive neurosciences. The topic of neurodiversity should also be included within this discussion, although to date, only a handful of formal studies have seriously considered it as a research topic; the most notable of these call for a deficit-as-difference conception of autism wherein neurological conditions represent equally valid pathways within human diversity (Kapp, Gillespie-Lynch, Sherman, & Hutman, 2012).

But, to date, with clear goals for establishing a theoretical construct that could explain autism across the entire spectrum, none of the proposed theories, even the current neurodiversity theory, have not yet been accepted universally. Mixed findings in the research continue questions about whether or not a single cognitive difference profile is actually present across the spectrum of autism (Dawson, Soulières, Gernsbacher, & Mottron, 2007), and the broad neurodiversity theory claims that finding difference does

not matter (Broderick & Ne'eman, 2008), although, many disagree. What is agreed upon is that cognitive processing in ASD is not the same as it is for neuro-typical individuals. This view has become even more widely accepted as the fields of genetics, neuro-biology, and neuro-physiology have begun to effectively map noticeable differences within the brains of individuals with ASD (Amaral, Schumann & Nordahl, 2008).

Cognitive Neuroscience Reports in Autism Spectrum Disorder

With still much to learn about cognitive processing in ASD (Rao & Ashok, 2013) and as the study of cognition expanded into the biological and cognitive neurosciences, a number of interesting brain-based theories about ASD have promised to shed new light on the unique thinking and learning processes that occur in autism. For example, neuro-anatomy studies have suggested that anatomical differences are present within the cerebellum for many with ASD (Amaral et al., 2008). In addition, researchers have proposed abnormalities in regions of the brain stem (Hashimoto et al., 1995), the frontal and parietal lobes (Amaral et al., 2008), the hippocampus (Otsuka, Harada, Mori, Hisaoka, & Nishitani, 1999), and the amygdala (Baron-Cohen et al., 2000).

In addition to physical structure differences, EEG studies have also suggested abnormal epileptic-type activity in a large percentage of those with the lowest-functioning forms of autism (Tuchman & Rapin, 2002). In other EEG reports (in line with some of the cognitive difference theories) abnormal responses to target stimuli have been observed alongside poor ability to generalize responses to stimuli that are outside the target of focus (Courchesne, et al, 1994). In these cases, individuals with ASD exhibit indiscriminate brain activity on both sides of the brain during tasks of shifting attention, where neuro-typical individuals show a more localized and predictable right or

left side response to a focus target (Courchesne et al., 1994). EEG studies have also focused on attention in ASD. In these, reports of significant findings of difference in the skills of rapid attention shifting, particularly for tasks of alternating attention between spatial locations and features of an object, seem to exist for those with ASD (Egly, Driver, & Rafal, 1994).

In other explorations proposed within the cognitive neurosciences, abnormalities in the density of neurons in the hippocampus, amygdala, and other parts of the limbic system have been reported (Bauman & Kemper, 2005). These have been associated with the difficulty in modulating sensory responses (Courchesne & Pierce 2005). Drawing from this research, Marco, Hinkley, Hill, and Nagarajan (2011) suggested that neuropathological differences affecting sensory signals towards hyper- and hypo-responding are present for those with ASD. In another study, individuals with ASD showed that certain cells (called Purkinje cells) which act to disinhibit are contraindicated in autism; this leads to sensorial overexcitement within the thalamus and cerebral cortex for some individuals with ASD (Fatemi et al., 2002).

In their meta-analysis of all magnetic resonance imaging (MRI) on brain morphology, Redcay and Corchesne (2005) suggested possible brain volume differences (some areas are increased, while other areas are decreased) within the cerebellum, the brainstem, and the posterior corpus callosum. Using MRIs in conjunction with volume analysis procedures and measures of head circumference, children with early forms of autism often show normal head circumference at birth, but by two to four years of age, 90% had brain volumes that were larger than average in the cerebellar and cerebral white matter and cerebral grey matter (Piven, Arndt, Bailey, & Andreasen, 1996). Piven et al.

(1996) added that this overgrowth is largest in the frontal lobes and cortical grey matter which might suggest a different trajectory of normal development and synaptic pruning.

In researching social specific differences as they present neuro-physiologically in ASD, Baron-Cohen et al. (1999) suggested that an amygdala deficit occurs in autism. More specifically, functional magnetic resonance imaging that examined individuals with high-functioning ASD found significantly less activation during tasks in which accurate categorization of emotions was required. However, researchers Dawson et al. (2002) reported contradictory findings for the Baron-Cohen et al. (1999) study, reporting high activity in those same areas of the brain in their group. Both Baron-Cohen et al. (1999) and Carver and Dawson (2002) concluded that differences in these areas can be related to facial-recognition abilities, leading to some with very advanced skills and others with facial-recognition skills that were non-existent.

According to Trikalinos et al. (2006), many cognitive and neural abnormalities in ASD are likely to be genetic, although researchers are only now beginning to narrow down genetic candidate regions. To date, no specific genetic mutations have been uncovered for ASD. Moreover, no consistent cognitive theories within neurobiology have been deemed specific enough or universal enough to characterize ASD singularly (Baron-Cohen, Lombardo, Tager-Flusberg, & Cohen, 2013). But, within a field that is rapidly changing, cognitive neuro-physiology and neurobiology still have much to consider in their exploration of cognition in ASD.

Sensory Processing

Regardless of IQ scores or even the broader forms difference that can exist in cognitive functioning for those with ASD, all individuals must find a way to successfully access, integrate, filter, process, organize, and act on the vast array of information that is present within the external world (Ayres, 1979; Cisek & Kalaska, 2010; Gilbert & Sigman, 2007). At the most basic level, the systems of sensory processing act as the interface between body and world (Ayres, 1979). In ASD, it is known that sensory processing differences exist (Rogers & Ozonoff, 2005). However, very little is known about how these manifest within the broader context of cognitive processing or about how these affect functioning on tasks of intelligence (Miller & Lane, 2000). Thus, with this topic as one of the primary three proposed for this research, the construct of sensory processing (both the general and the specific for those with ASD) is reviewed here.

Sensory Processing as a Non-Linear System

According to Buzan and Buzan (1993), in order to begin to understand sensory processing, especially for its implications in ASD, there must first be an altering of existing paradigms that underlie current thinking to recognize that within cognition, the tasks of sensing, perceiving, organizing information, thinking, and performing do not occur in linear sequences and the components that make up these processes are not distinct. Therefore, the mind-body interface system that we refer to as the *sensory processing system* must work continuously and in constant relationship to all other parts of peripheral and central nervous systems, both from the inside out as well as from the outside in. This all happens under the very broad umbrella of the cognitive processing system (Buzan & Buzan, 1993).

Sensory Processing Disorders

Jean Ayres (1972, 1979) understood at least some of the complexities of the sensory processing system for its ties to cognition and intelligence. According to Ayres, a noted neuroscientist and occupational therapist, certain individuals struggle with the "neurological process that organizes sensations from one's own body and from the environment making it impossible to use the body effectively within the environment" (1972, p. 11). With this, Ayres formed her sensory processing theory wherein she suggested that learning and performance (as functions within the brain) would be hampered if some neural function caused the higher centers of reasoning to be unable to integrate, modulate, or regulate incoming information (Schaff & Miller, 2005). Ayres' theory addressed the five primary senses (touch, sound, sight, taste, and smell), but also incorporated the sensations of movement and pressure into the theory (DiMatties & Sammons, 2003).

Sensory Processing Therapies

Within Ayres' (1972) work, the idea was born that sensory difference occurred for some children. As Ayres viewed the everyday exepriences of childhood through the lens of physical experience, she logically followed that idea by exploring improving learning and performance abilties through sensory therapies that expanded on building normal sensory experiences through the field of occupational therapy (Miller & Lane, 2000). Spending much of her life's work designing *sensory integrative approaches* to stimulate and enhance the brain's capacity for increased perception, Ayres believed that movement used specifically to advance development in sensory processing would have a

positive affect on learning, performance, and the executive functions of planning and completing tasks (Schaff & Miller, 2005).

Unfortunately, many of the sensory integration practices that Ayres proposed did not bear out in the evidence-based literature (Arendt, MacLean, & Baumeister 1992; Polatajko, 1992; Vargas & Camilli, 1999). According to Miller, Coll, and Schoen (2007), because the field was in disagreement about terminology and lacked enough rigorous effectiveness studies (especially in pediatric populations) to prove that the techniques of Ayres really worked, the lack of effectiveness for the treatments tainted the theory. Although this belief is yet to draw serious consideration overall among educators, a few of Ayres' points have made their way into the classroom. For example, Case-Smith (2002) provided strong clinical findings to support the benefits of occupational therapy practice for handwriting.

Even though many of the Ayres' practices were not proven to be effective, Cermak and Henderson (1990) reported that more than 50,000 therapists in the U.S. alone used sensory integration techniques with paying clients in their private practices. In a more recent qualitative study by Cohn, Miller, and Tickle-Degnen (2000), parents who paid for sensory integration therapies reported that the movement-based activites of sensory integration helped their children in the areas of social participation, self-regulation, and physical competence.

The Re-Emergence of Sensory Processing Theory

For reasons that are only beginning to surface in the field of neuroscience where researchers can now more accurately examine the nervous system as it interacts with the environment and affects learning, Ayres' original theory still may have been correct

(Dunn, 1997). Dunn reviewed new theories about sensory processing that were emerging out of the neurosciences and put forth a conceptual model for integrating findings from the neurosciences to align them with the sensory processing theories proposed by Ayres and others from the cognitive and behavioral traditions. Within these alignments, Dunn (1997) established that the sensory system is, indeed, a complex system that exists in relation to both the central and peripheral nervous systems. Ozonoff and Strayer (1997) added that the sensory system interacts with cognition through executive functioning. According to Miller, Robinson, and Moulton (2004), effective sensory processing requires both integration (the accurate processing of sensory stimuli) and modulation (the brain's tuning and regulation of its own filtering system). Miller et al. (2004) stated further that sensory modulation, perhaps even more than integration, drives mental, physical, and emotional products and keeps the mind-body-world in sync.

With new evidence from the neurosciences lending support to some version of sensory processing theory, Miller and Lane (2000) re-examined terms across fields and put forth a summary that was intended to lay a consistent foundation upon which future researchers and practitions could communicate and move forward to explore sensory processing. Relevant to this review, as cited by Miller and Lane (2000), the following key assumptions from the study of sensory processing are provided:

- Sensory processing occurs at the neurophysiological level and, therefore, cannot be observed.
- Although the central nervous system is a highly complex system of chemical and electrical activations and transmissions, the integrative process that gives

meaning to information develops through association with activities and objects that are significant to the child.

- The central nervous system process that receives, modulates, integrates, organizes, and reacts to sensory input from the environment is called the sensory processing system. This system is similar to the sensory integration system described by Ayres (1979), but encompasses a broader set of functions.
- Sensory detection is the first of the sensory processes that occur within the central nervous system. Sensory detection activates the cognitive processes of sensitization, habituation, facilitation, supression, inhibition, and summation.
- Neuromodulation is the overall process within the central nervous system that activates synaptic and hormonal changes which allows for continuous chemical and electrical adaptation to the environment. Sensory processing occurs within neuromodulation.
- Sensory modulation is the specific subtype within the neuromodulation process that conveys information about how intense, freqeunt, lasting, complex, or new a particular sensory stimuli actually is.

Zimmer et al. (2012) added that in the past five years, as these key assumptions have been adopted and understood, sensory integration therapies have seen another dramatic increase. According to Schaff and Miller (2005), while the practices of sensory integration have still not been properly evaluated, sensorimotor development as proposed by Ayres is, in fact, still an important element that researchers are finally begnining to recognize within the broader physiological make-up of cognition and learning.

Sensory Difference in Special Populations

Children with a variety of different learning disabilities are much more likely than their neuro-typical peers to experience sensory processing disorders according to Ayres (1979). At the bottom of the bell curve (Ayres, 1979), many children with intellectual disabilities struggle to process sensory information. Ayres (1979) added that sensory processing challenges for those who are intellectually disabled are most often found in the skills of integration and are less pronounced in sensory modulation because of more evenly developed skills (Ayres, 1969).

Interestingly and of particular relevance to the research topics of this study, at the high end of the standard bell curve, sensory processing differences are quite common in those who are gifted, especially when individuals who are gifted are asynchronously developed (Daniels & Piechowski, 2008; Kranowitz, 1998). In fact, within the field of gifted education, it is widely held that sensitivity and over-excitability are common and normal conditions affecting processing for many gifted individuals (Dabrowski,1966; Mendaglio, 1995). Although Dabrowski, the originator of the *sensitivity in the gifted* theory, published his original work in Polish, literally translated, his definition of the term *over-excitability* suggested that some individuals who are gifted experience a heightened physiological reaction to both outward and inward stimuli that results from increased neuronal sensitivities (Dąbrowski, Kawczak, & Sochanska, 1973). According to Piechowski (2009), this is especially noticeable when IQ scores fall into the profoundly gifted range (above 145).

In 2009, Gere, Capps, Mitchell, and Grubs suggested that *bright* and *bright but asynchronous* children take in more sensory information than their peers; thus, sensory

modulation issues are common. According to Moonlial (2007), sensory processing difference is recognized in at least 35% of all children who are gifted. These numbers increase dramatically for those who are twice-exceptional (Gilman et al., 2013). But in giftedness, unlike other fields, sensory processing difference is embraced within the idea that heightened sensitivities are common characteristics of giftedness (Piechowski, Miller, & Daniels,1995). At the extreme end of acceptance for sensitivity and sensory difference in giftedness, Dabrowski (1966) linked heightened sensitivity and over-excitability to the possibility of advanced forms of evolution and emergence.

Sensory Difference in Autism

According to Marco et al. (2011), atypical sensory processing is a "ubiquitous feature of autism spectrum disorders" (p. 1). Over 96% of individuals with ASD report hyper-sensitivity across multiple domains of sensory processing (Leekam, Nieto, Libby, Wing, & Gould, 2007). Although sensory differences in ASD can range from mild to severe, most sensory differences endure well into adulthood (Crane, Goddard, & Pring, 2009). Within a growing movement charged mostly by adults with ASD, known as the Neurodiversity Movement (Armstrong, 2010; Fenton & Krahn, 2007), it has become widely accepted that understanding sensory difference in ASD is critical to tailoring appropriate and effective programs and treatments (Marco et al., 2011). However, very little is still being done to address sensory difference in ASD within traditional learning environments, and the ways in which individuals with ASD experience and perceive sensory difference is still not clearly understood (Miller & Lane, 2000). This means that sensory difference has yet to be explored for its effects on cognitive processing or for its implications on the demonstration of intelligence.

Clinical Reports on Sensory Difference in Autism Spectrum Disorders

Within the field of autism, Rogers and Ozonoff (2005) conducted a complete review of all primary studies that had considered the topic of sensory processing within autism specifically. Their report included 48 primary empirical papers and suggested that unusual responses to sensory stimuli were seen in almost all studies on children with an autism diagnosis. Rogers and Ozonoff (2005) also reported on the sensory symptoms that were most frequent and occurred with greater prominence for children with ASD. Their study specifically considered over- and under-arousal theories in the autism spectrum. In this review, they concluded that at the time of their analysis, there simply was not enough research to support or refute a hyper-arousal base to sensory processing difference in autism, although clear reports of hypo-responsivity for certain sensory signals were well supported as one of the salient characteristics of ASD. In addition, the Rogers and Ozonoff (2005) review concluded with a discussion about the need for additional research on sensory differences across the spectrum of autism and suggested that sensory processing difference (both hyper- and hypo-awareness for sensory input) in autism was a significant feature of the disorder and could be likened to some of the more severe sensory differences seen in other populations who are disabled.

According to Leekam et al. (2007), individuals with higher-functioning forms of autism, such as those with Asperger syndrome, also report high degrees of sensory difference to a degree that negatively affects day-to-day processing. Yet, while sensitivity and even under-registering of sensory stimuli are heavily reported in the literature (Rogers & Ozonoff, 2005), much less is known about the exact nature of these

sensory differences or about how affected individuals perceive their unique experiences in sensory processing.

Ben-Sasson et al. (2009) also considered sensory symptoms in individuals with ASD through yet another comprehensive meta-analysis of studies. They concluded that while sensory modulation symptoms are common in persons with ASD, the symptoms have an extremely heterogeneous presentation. According to Ben-Sasson et al. (2009), the presence and frequency of sensory symptoms with the greatest difference are reported in under-responsivity. Over-responsivity and sensation-seeking followed closely behind and were moderated by chronological age and the severity of the ASD condition. Ben-Sasson et al. (2009) reported that sensory differences are highest in young children and may resolve somewhat as children mature.

Neuro-Biology and Sensory Processing in Autism Spectrum Disorders

According to Bakley (2001), differences in sensory processing have a significant and negative effect for individuals with ASD, and many of these can be tied to differences in neurobiology within the brains of those with ASD. Shomstein and Yantis (2002) added that given the complex relationships between sensory processing and cognition, outward behaviors change for individuals with sensory difference because those affected struggle to discriminate, prioritize, and attend to stimuli, which results in uncharacteristic responding. But during the 1990s because the sensory processing theory of Ayres was tainted by a lack of evidence for its treatments, the trail of studies exploring sensory processing difference within either the cognitive or behavioral traditions grew cold. It is only within the last five years that sensory considerations are re-emerging for those with ASD.

Picking up where cognitive-behavioral traditions left off, the field of neurobiology is just now beginning to re-open the sensory processing difference line of inquiry for further consideration. A few of the primary topics being researched have reported the following findings: (a) increased activity in certain sensory areas of the brain that are normally associated with stimulus driven processing combines in ASD with decreased activity in areas that are associated with higher cognitive processing; and (b) hyper-arousal research has found that a decreased ability to select between competing sensory inputs results in sensory over- and/or under-responsivity (Baron-Cohen et al., 2007; Markram, Rinaldi, & Markram, 2007). Within a fresh body of evidence that is continually expanding the important role of sensory processing for normal functioning along with clear and consistent evidence to support sensory processing differences for individuals with ASD, Markram and Markram (2010) concluded that a greater understanding about sensory difference is needed before researchers can even begin to understand how what now appears to be an entirely different neurobiological make-up manifests for individuals with ASD.

Baron-Cohen et al.'s (2007) hyper-systemizing theories in cognitive difference and Markram and Markram's (2007) view of autism as the extreme state of sensory dis-regulation have further tied sensory processing differences to ASD; thus, these two top researchers in the field have stated that deeply seated neurobiological difference within the sensory processing system can essentially account for all of the problems associated with social interaction, attention, and learning in ASD. With this view, Markram et al. (2007) even proposed an additional and emerging sensory-based theory about cognitive processing in ASD that, again, essentially blames too much sensory information

processing along with poor sensory discrimination as the leading cause to all system failures in ASD.

Although the sensory processing sections of this review aligned with a number of differing cognitive theories in ASD, it should be noted that the Baron- Cohen et al. (2007) and Markram et al. (2007) cognitive processing theories are the only two emerging theories on cognition in ASD that take into account recent findings about sensory difference in ASD from the field of neurobiology. Thus, the most emergent cognitive processing theories are now drawing heavily from the original ideas of Jean Ayres (1979), doing so with the inclusion of the Miller and Lane (2000) proposed terminologies and foundations to suggest that cognitive difference in ASD begins with significant and global neurophysiological differences in sensory processing.

Summary from the Literature

While much is still unknown or even contradicted about ASD, in reviewing the literature for the topics of intelligence and its measurement, cognition, and sensory processing, some things do seem clear. They are summarized here.

- First and now virtually undisputed, despite changing terminologies and diagnostic criteria through the years, ASD is on an alarming trajectory of increase (CDC, 2014, Boulet et al., 2011).
- Second, the condition, whether mild or severe, has a significant and negative effect on socialization and learning (Risi et al., 2006).
- Next, for the majority of those with ASD, intellectual disability, as predicted through current IQ testing instruments, remains predominantly assumed (McMahon & Ritvo, 1989; Bryson & Smith, 1998).

- Also, while a number of unique cognitive difference theories have been heavily researched, none yet appear to be universal (Rajendran & Mitchell, 2007).
- Within some of the prevailing cognitive difference theories, the deficit-specific models surrounding *mind blindness* (Frith & Happé,1994) and executive functioning (Ozonoff et al., 1991) stand out.
- Cognitive difference theories that emphasize strength-based differences include theories of systemizing (Happé et al., 2001) and the emerging sensory-based theories of hyper-systemizing and responding (Baron-Cohen et al., 2007).
- Also, and almost universally agreed upon, is the fact that some form of sensory processing difference underlies the condition for nearly all affected individuals (Marco et al., 2011), although what these deficits present with or how they manifest in tasks of performance such as IQ tests is not yet clear.
- Within the sensory processing research, it does seem that many individuals with ASD show either hypo-sensitivity or hyper-sensitivity (Rogers & Ozonoff, 2005); other sensory processing differences are just beginning to be understood for their relationship to cognition and learning within the cognitive neurosciences, although none are yet fully explored (Ben-Sasson et al., 2009).
- The most current sensory difference theories now combine hyper-sensitivity with executive functioning and social difference theories to explain the core features of ASD (Markram, Rinaldi, & Markram, 2007).

- To date, even with what is now known in the fields of behaviorism, cognitive learning theory, cognitive neurosciences, and sensory processing theory, the only universally accepted and research-approved therapies for the treatment of ASD continue to be found within the traditions of behaviorism (Lovaas et al., 1965; Kasari & Lawton, 2010).
- Additional and trending research in the field of neurobiology, especially when data are analyzed within complex systems-based computing, claims to be on track to finding solutions about autism that others have missed (O'Reilly & Munakata, 2000). But, these lines of inquiry are also being criticized for failing to consider a larger, more holistic strength- and difference-based world-view on autism (Rao & Ashok, 2013).
- The recent neurodiversity theory being forwarded by many of those with the condition is still in its infancy and as a cognitive-difference model only proposes the need to recognize difference, instead of diagnosing disability.

Thus, within what is known, there exist a number of notable assumptions that deserve to be questioned to more fully address learning for those with ASD. These are highlighted here.

- The first assumption is that there is a universally agreed upon definition of autism. As it stands today, continually changing definitions and the lack of long-term agreed-upon diagnostic criteria have led to inconsistencies in the evidence-based research that have both confounded the body of research and complicated its interpretation. As such, best-practices for the treatment of

ASD have been driven by a lack of consistent understanding or consensus about what is or is not typical within the condition(s) of autism.

- Second, and perhaps the most problematic, is that intellectual disability continues to be assumed in autism. Based on a dated IQ construct evaluated within an assessment system that might not be particularly valid for this group due to their cognitive and sensory processing differences, IQ scores continue to drive programming and expectation across all educational environments. This continues, in spite of first reports in autism that were tied to giftedness, the reporting throughout history of the savant condition, surprising numbers of ASD children being identified in gifted programs, accounts of high familial intelligence in the STEM fields for those with ASD, and the large numbers of GT/ASD learners who are silently making their way toward college and university settings.
- Another problematic assumption is that the developmental world-views on behavior and cognition are able to aptly capture cognitive abilities and differences for those with ASD. Cognition, as properly defined, includes all mental abilities. Yet within behavioral, cognitive, and even neurobiology traditions, because deep cognitive processes cannot be observed, measured, or replicated through computing, theories to explain ASD continue to depend heavily on observable stimuli, measureable response, and visible difference. In this world-view, the primarily language-based tasks of memory and recall are heavily associated with learning and vocational outcomes—even though measuring the first of these is often problematic for those with ASD and

according to the body of evidence, the second is certainly prioritized and executed differently. Moreover, as critics of the existing IQ construct have suggested, traditional definitions of language processing may no longer predict vocational success across all fields.

- Thus, the existing world-views on intelligence and its measurement, cognition, and the role that sensory-processing difference plays on traditional academic testing and performance abilities might fail to account for any number of different cognitive processing styles and also might fail to predict vocational outcomes, particularly within some of the higher-order remembering, thinking, and problem-solving careers within the STEM fields.
- An additional problematic assumption is that the way humans perceive and process sensory information from the external world should be the same for everyone. Perhaps the real value of Ayres' (1972) sensory integration theory is that it scratched the surface of understaning how truly complex, pervasive, and multi-dimensional the effects of sensory processing are for all levels of cortical processing. With the sensory system now recognized for its involvement at the neocortical level in nearly all levels of cognitive processing, it is no wonder that the demonstration of intellectual ability or learning and performance, as they are currently defined, could be negatively affected by sensory-processing difference.
- Similar to the argument above and of paramount consideration within this research is the final assumption that must be questioned; should everyone be normal? Within the existing developmental and ontogenetic world-view,

those with ASD are dissected and classified for their deficits, when a more *whole-istic* view might reveal both challenges and strengths that are the *normal* for those with ASD.

- Through advances in neurobiology, researchers claim to be able to see visible differences in the brains of those with ASD. But without the ability to analyze these differences within their broader, systematic global functioning as a *whole system*, a large number of disconnected brain differences are continuing to be explored as abnormalities. In ASD, these differences, some even currently viewed by those with the condition as strengths, might, in fact, be *normal* for those with neural-development along the autism spectrum.
- Moreover, the very cognitive and sensory differences that present challenges within existing constructs and frameworks might, in fact, be viewed as gifts and strengths within alternative worldviews. In Armstrong's (2010) article "Your brain is a rainforest," he essentially suggested that neurodiversity in humans might very well be as necessary to the survival of the human species as biodiversity is to the survival of the planet.
- It appears that in some circles, such as in the field of giftedness, altered sensitivity is viewed as a difference in processing at the neuronal level that allows for increased evolution. All combined, it would seem that perhaps within the field of autism, the possibility that cognitive and sensory processing differences that are evolving toward a universal mind-body-world *difference* theory, such as that of Markram, Rinaldi, and Markram (2007) in their intense world theory, is certainly possible.

- Based on the findings of this literature review, it seems that ASD might, in fact, present within a significantly different form of cognitive and sensory processing and that this, in turn, could challenge assumptions about intelligence and its measurement for those with ASD. With all of this at its foundation, this study explored the topics of intelligence, cognition, and sensory processing for their interrelatedness by exploring the lived experiences of several adult individuals diagnosed with the autism spectrum condition.

CHAPTER III

RESEARCH METHODS AND PROCEDURES

A Qualitative Grounded Theory Study in Social Constructionism

With little specific clarity in the literature to explain, describe, or understand the unique and specific cognitive and sensory differences that interplay with IQ and the demonstration of intelligence for individuals with ASD, I conducted a qualitative inquiry within the theoretical framework of social constructionism to explore perceptions on the research topics of intelligence, cognition, and sensory processing with 14 adults diagnosed to be on the spectrum of autism. With the existing literature as both starting point and guide, I utilized a grounded theory methodology to frame the study, which I believed would best allow me to explore my research topics and to create and *ground* a new theory pertaining to the ways that cognition and sensory-processing differences in ASD interplay to affect the demonstration of IQ and, ultimately, the pursuit of academic and vocational potential for those diagnosed with ASD. Both the rationale to support and the limitations of the proposed research design are detailed in the following sections.

Research Design

According to Delanty (2005), modern thought, with its origins in the 16th century, evolved out of the belief that self-understanding held answers to the essential questions of life. Delanty furthered that human engagement in research within the social sciences

emerged naturally as early scholars began to consider the conditions of humanity. This evolution of understanding literally transformed the social world as we know it today (Delanty, 2005). From early positivist disputes on explanation versus understanding to debates about the sources of reality and knowledge, he concluded that all of the major theoretical frameworks and research designs in use today emerged alongside each of the major shifts in human understanding through the years.

A Qualitative Approach

Within research designs, Merriam (1998) has provided a specific definition for qualitative research that defines it as a method of study intended to develop human understanding through deep and purposeful inquiry. According to Creswell (2009), in qualitative studies, the researcher considers how things occur, with the goal of producing studies that are both descriptive and emergent.

More specifically, the qualitative researcher focuses on how things happen with an emphasis that is on the particulars, rather than on the generalizable (Creswell, 2009). Accordingly, qualitative studies are developed with negotiated outcomes and reconstructed realities, (Guba & Lincoln, 1989) between the researcher and the participants. As such, these types of studies produce assertions from the researcher that are instantiated in intuition and *felt knowledge* (Crotty, 1998). With these objectives, I purposefully chose to conduct a qualitative study so that I might more deeply explore my selected research topics with the participants. It was my hope that through the use of a qualitative approach, I would be able to focus my inquiry on the specifics, then relay my findings through descriptive analysis in such a way that the study's *truths* would eventually emerge.

Because the focus of qualitative research is to deeply explore and understand how groups or individuals make meaning about social or human problems, the qualitative researcher must be both flexible and inductive in their approach (Creswell, 2009). When done correctly, Creswell (2009) added that the strength of qualitative research is in its ability to "render the complexity of a situation" (p. 4). But, qualitative studies also pose challenges. According to Creswell (2013), they (a) require a deep level of insight and reflexivity from the researcher; (b) demand a high level of researcher involvement with the participants; and (c) unlike the more deductive and straightforward methods for data collection and analysis in quantitative studies, rely heavily on the inductive process of the researcher. As such, the success of the qualitative study is heavily reliant on the *researcher-as-instrument* in the research. This requires researchers to wear a lot of hats as they strive to understand themselves, their biases, their processes of discovery, and their lenses of interpretation.

Given that the goals for this inquiry were to explore meaning and relationship between three broad theoretical concepts, there simply was not a quantitative method that could begin to address the issues in this study. But to do this work justice, I obviously needed to be both learned and aware of my influence as researcher throughout this inquiry.

Social Constructionism as a Theoretical Framework

Merriam (2009) reported that all qualitative studies emerge from the researcher's world-views and from the theoretical ways in which they frame their work. Trochim and Donnelly (2001) added that theoretical perspectives come from the realm between what goes on inside of a researcher's head and what they observe in their external world.

According to Merriam (2009), theoretical frameworks applied within qualitative studies drive such things as how questions are phrased and then developed into problem statements, and they also underlie the structure, scaffolding, and frame for the entire study. With this, Merriam (2009) added that a researcher's theoretical framework establishes both the systems and the concepts that are used to *ground* the research. As such, the disclosure of a theoretical framework provides a foundation for the reader to interpret the assumptions, expectations, beliefs, and theories presented within the study. Denzin and Lincoln (2005) added that these *frames* are analyzed by the reader to more fully align the studies pragmatic foundation with its findings for a better understanding about the researcher's assertions on meaning. But, with a variety of different theoretical frameworks possible on any topic of inquiry, one might ask how qualitative inquiries can ever arrive at meaning. Merriam (2009) suggested that it is through this inherently rich tradition of researcher diversity that deeper and more meaningful understanding is eventually achieved. For this study, I chose to align with the theoretical framework of constructivism.

According to Shank (2006), the postmodern trend toward constructivism was first established in the works of von Glasersfeld (1989), but then gathered momentum and reached its full development potential in the 1990s (Egon, 2005; Seale, 2004). With a perspective that all knowledge, not just that of the research participants, is socially constructed and shared through language, two different constructivist frameworks became distinguishable over the years; the first took a biological or systemic view and the other emerged within a sociocultural tradition (Guba & Lincoln, 1989). For this inquiry, I aligned with the latter, framing the study within the sociocultural tradition of

constructivism. This was a difficult decision, given the dependence on language in the constructivist tradition; but I decided that without some method of functional communication, I could not know the experience of those with autism. Unfortunately, this decision limited the study to those individuals who had found some method of communicating.

With views similar to relativism (Burr, 2003; Patton, 2002), social constructivists share the belief that there is no such thing as absolute knowledge. Instead, all living beings construct *necessary knowledge* for their survival (von Glasersfeld, 1989). For constructivists, when knowledge is constructed rather than just stumbled upon, control of the world is the result (Shank, 2006).

In its purest form, the underlying paradigm of constructivism holds that no two people can share the exact same life. Therefore, both emotion and thought must evolve from our individual experience. Within the branch of social constructivism, in particular, Vygotsky (1962) added that truth is, most importantly, grounded in one's social, historical, and cultural experience and shared through language-based interaction. But, constructivism isn't that simple when considered along with some of the other major theoretical frameworks in the social sciences. Guba and Lincoln (2005) described constructionism with a relativist's ontology, a transactional epistemology, and a hermeneutic, dialectical methodology. Schwandt (2007) added that while the paradigm beneath social constructionism has evolved from very elusive terms and perspectives, the framework essentially considers knowing to be active, created, and continually tested and modified within the "inevitable historical and socio-cultural dimension" (p. 38). To me, this means that for the social constructivist, the human mind is active in its construction

of knowledge, and it creates knowing through communication and discussions about shared understanding and experience that has been obtained from the various aspects of the world in which we all live. With this history and these foundation descriptors, I formed my alignment with social constructionism for this study, and I developed and interpreted this study around that theoretical framework.

Essential Tenets in Social Constructionism and How These Were Addressed

Within social constructionism, Guba and Lincoln (1989) provided several tenets that they believe to be essential to forming a philosophical framework in the constructivist tradition. Using these, I formally established links to my personal philosophy, and I tied them to the study's framework.

First, constructionism suggests that truth comes out of a process of evolution, whereby consensus is derived among various informed and sophisticated constructors (Guba & Lincoln, 1989). In this study, I asked for volunteers, then selected 13 adult individuals who had been diagnosed with ASD to work with me in a shared construction of meaning about the research topics in this study.

Second, according to Guba and Lincoln (1989) within constructionism, facts do not have meaning alone, but only become meaningful when they are valued within some framework; therefore, nothing is truly objective. In this study, to address my assertions of *truth* about the perceptions I gained on intelligence, cognition, and sensory processing in ASD, I openly disclosed my stance, process of reflexivity, and basis for reporting my biases. I also grounded the full report, from research question to basis for assumption within the framework of social constructionism, so that the meaning I found could be understood and valued within my theoretical framework.

Guba and Lincoln (1989) stated that to the constructionists, phenomena can only be understood within context and they cannot be generalized. Therefore, in my study, I then explored my research questions with adult members of the ASD community. In this way, and because of significantly different upbringings for these individuals, I also attempted to consider social, economic, religious, and even societal contexts for these individuals to place their stories as they related to my research questions. Then with constructivism as my guide (even when faced with very interesting commonalities between the reports of these individuals), I maintained individual perceptions as separate and distinct, thereby retaining meaning for each participant within the context in which each understood the phenomena under inquiry. Within this, all data collected in the proposed study were evaluated as simply another *construction* to be taken into account in the process of reaching consensus within the framework of constructionism (Guba & Lincoln, 1989). More specifically, I considered each individual report for its unique and distinct contribution toward my arriving at consensus for my findings about the reports of the participants.

Finally, constructionism purports that cause and effect do not exist, except by the ascribing of attributes from one person to another. I interpreted this to mean that within qualitative research and under the theoretical framework of constructionism, consensus for understanding and knowing comes only through the integrative process of considering and reconsidering the individually constructed truths of individuals toward an eventual understanding for the whole (Maréchal, 2010).

Rationale for my Theoretical Frame in Social Constructionism

With a personal world-view that closely aligns with social constructionism, I could hardly take on this study from a different theoretical perspective. However, I was also aware when I began that a number of challenges would potentially emerge within this theoretical framework of choice. Gergen (1996) presented three of the most essential challenges he saw that social constructionism researchers face: the challenge of empiricism, the challenge of reflexivity, and the challenge of creativity.

According to Gergen (1996), first and foremost, the constructivist has the tendency to view hypotheses testing about a single universal processes of the mind as misguided and even wasteful because:

> not only is the subject matter itself a social construction, thus not subject to empirical evaluation outside a particular tradition of interpretation, but such research represents the arrogation of a uniquely western ontology of the mind to the status of the universal" (p. 7).

Gergen (1996) suggested that researchers address these issues of objectification in their studies by revising outcomes to target societal concerns, challenge traditional assumptions, and share information that is relevant to those involved in the inquiry. Within this study, I intended to challenge both the societal views on high rates of intellectual disability in autism and to support or refute the existing cognitive theories that have attempted to narrowly explain the core features of the autism condition.

Gergen (1996) reported that the second major challenge for researchers working within the framework of social constructionism is being able to reflexively deliberate. He explained that:

> As people in relationships move toward collective agreements on what is real, rational, and right, to reflect critically on one's pursuits, using the very

> rationalities that legitimate these pursuits, one can scarcely do other than rationalize the status quo. More importantly, those who do not share the premises are rendered "other" and are often dismissed, disparaged, or denigrated. (p. 9)

To solve issues with researcher reflexivity, Gergen (1996) posited that the processes of reflexive deliberation must take into account the "historically and culturally situated character of the taken-for-granted world" (p. 10). Within this research, I found it most difficult to take on the role of reflexive deliberation because it forced me to put aside my own training and belief about autism in order to properly situate myself for the undertaking of considering autism as one who does not have autism. With data as my guide, I found that in order to be reflexive, I needed to overstep my own preconceived notions and, instead, use the raw data as my new version of truth. Only then, could I truly reflect on and legitimize the findings of this inquiry with those who live with the realm of autism.

As a final challenge that researchers face when working within the social constructionists' paradigm, I again aligned with Gergen (1996) and his report of the creative challenge. Gergen explained that traditional social science research has primarily been content with methodologies proposed by the behaviorists; namely, to give an accurate account of the observed reality. But within social constructionism, because reality is formed and interpreted through the collective and the historical, the researcher in the social constructivist tradition must creatively consider all discourse within the culture of human life (Gergen, 1996). In so doing, they "mold the intelligibilities of the culture—making distinctions, furnishing rationales for action, and implicitly evaluating forms of conduct—they also prepare our future" (p. 11). Literally interpreted, Gergen called for the social constructivist to "enter into the creation of new forms of cultural life"

(Gergen, 1996, p. 12). As I began the study, this calling felt a bit insurmountable to me, and my feeling of ineptness grew as those in the study questioned my authority to "study them." But with ideas that emerged as I gathered the data alongside grave concerns from the participants about my ability to accurately capture autism without first living it, I found that I could relay only what those in the study shared; in so doing, I was, indeed, able to explain and possibly even create a different world-view about the culture of autism.

Grounded Theory Methodology

While many forms of qualitative research focus on the stories of the individual or even the collection of common experiences for a group, according to Creswell (2013), grounded theory research is undertaken with the intent to move beyond descriptors—to generate or discover a new theory about a particular process or action. First proposed by Glaser and Strauss in 1967, the methodology was developed with the intent of returning qualitative researchers to the actual data for the purpose of *grounding* their findings and generating new theories. In its purest form, grounded theory research called for the development of analytical questions, formal hypothesis statements, and a visual diagram to detail the theoretical relationships being asserted by the researcher (Charmaz, 2000). But, after taking on several projects together that required consensus of procedure, even Glaser and Strauss disagreed about how formal the procedures needed to be (Creswell, 2013). Having read about some of the core differences between the beliefs of Glaser and Straus (1968), my natural inclination for this research was to side with Glaser for a methodology that is less prescribed and structured than the one proposed by Strauss (1987).

Alignment with the Constructivist Branch of Grounded Theory

In recent years, Charmaz (2006) proposed a constructivist form for grounded theory. Based in the relativist ontology and the subjectivist epistemology, Charmaz (2000) felt that the interaction between researcher and participants could be used to *construct* meaning with researcher-as-author. Charmaz (2000) explained, "Data do not provide a window on reality. Rather, the "discovered" reality arises from the interactive process and its temporal, cultural, and structural contexts" (p. 524). According to Charmaz (1995), in this way, grounded theory research leads to multiple meanings. To address these, Charmaz (2000) charged researchers first with the task of *immersion* in the data to honor and maintain the individual voice of the participants, then with the task of producing a narrative that is both analytical and literary in ways that evoke the life of the participants. With a sense of co-creation in mind, and within Charmaz's (1995) view that the very process of interaction can lead to multiple meanings that can be relayed through the voices of those in the study, I aligned this work with the constructivist method of grounded theory research as proposed by Charmaz (2006).

Defining Features of Grounded Theory and How These were Addressed

According to Creswell (2013), grounded theory studies usually employ the following: (a) a focus that is on a process or action over time; (b) development of a theory to explain this process or action; (c) memos and/or sketches of ideas toward the development of theory; (d) interviews as the primary form of data collection; and (e) a data analysis procedure in which data are coded first for open categories, next for the selection of a focus or primary category, then last for support of the categories towards

the theoretical model. Within the constructivist version of grounded theory methodology, in particular, Charmaz (2006) added a final feature by suggesting that the final outcomes of a grounded theory study, while somewhat suggestive, will always remain incomplete and inconclusive.

Rationale for the Use of a Grounded Theory Methodology

Creswell (2013) suggested that there are a number of challenges and limitations within grounded theory research. As the first of these, the researcher must put aside any pre-conceived ideas or notions about theory from the outset, thereby analytically allowing the *true* theory to emerge. Given strong opinions and existing views about possible relationships between the constructs of this research and their potential relationships, I anticipated this step being the hardest for me. But, I undertook this study anyway with an open mind, set my own theoretical opinions aside as best I could, then followed the systematic approach of gathering the data and distilling them for their categories, primary category, and the resultant theory. What I did not anticipate, however, was how much self-awareness the process would take. At one point, because I found myself so deeply connected with some of the participants, sharing, reliving, and even relating to them, I had to deliberate on the question "Do I have some autism?" More specifically, I found that I, too, have some significant sensory issues (mine most likely related to my 1997 TBI). But as I questioned everything about myself and everything about the data in front of me, even though I could not begin to capture my process of deliberation in the linear, sequential notes of my research notebook, to my amazement as I went round and round the data in my mind, the process worked! In my alignment with Charmaz's (2006) constructivist grounded theory, I believed that I would have a bit more room to work

from my gut and instincts (which is also strongly in my nature), and I knew that I would need to be systematic, but I did not realize that I would also need to take into account my entire life's work to arrive at my "aha" moment.

An additional challenge and limitation within this type of research, according to Creswell (2013), is the determination point for *saturation* of the categories and detail of the theme. In other words, when is the data collection procedure complete? Creswell (2013) suggested that once the researcher begins to hear the same things over and over and it seems that the data categories are filled, then saturation might be met. But, after the coding procedure is complete and the theory has been discovered, the researcher should use a discriminant sampling procedure to determine if the emerged theory holds true for several new participants. In this study, I had so many categories in the beginning that I thought I would never achieve full saturation of the data for each individual. But because I anticipated that for this population in particular and there might be multiple ways in which the participants described their experiences, I found that by subgrouping and condensing the various categories, I was able to achieve several primary categories. From there, I re-interviewed several of the participants to confirm my categories and the emerging theme that seemed to be coming from them, and this finally led me to a level of saturation about the topics of the research that seemed complete; still, it was clear that had I pursued each and every one of the primary categories, I might never have achieved saturation.

As a second limitation, I initially thought I might have difficulty accessing the participants. This was true. I found that I had to recruit participants by running the recruiting flyer on several different occasions; then, in the end, I also used my social

networking sites (Facebook and Linked In) to recruit the remaining participants within a convenience sampling procedure.

Finally, with reliance on phone calls and online conferencing tools for those outside of the United States for the follow-up discussions, I needed to be quite persistent without being overly pushy to collect all the data that I required on this topic. In several cases, I found that I needed to interview participants two or even three times to achieve saturation of their data. Finally, once my themes were established, I selected three participants whom I felt were the least annoyed by my continuing calls and contacted them to share my emerged theory. After I felt confident that the theory was accurate with my participants, I interviewed three additional members of the autism community (diagnosed, but not one of the 14 participants) to determine if the theory held true with individuals not in the original sample.

Last, Creswell (2013) suggested that grounded theory approaches are sometimes challenged by the very expectation of a final outcome that must include a theory, which can be especially challenging for new researchers. When I began the study, I thought I understood this process. But, it wasn't until I really started digging through my data that I gained a full understanding and fully realized that this type of research relies heavily on one's skill and ability to move back and forth between the inductive and deductive. Thankfully for me, this processing style came somewhat naturally. I discovered that my own highly abstract, albeit rather non-sequential way of thinking (the same one that has plagued me in many other areas of my life) finally gave way to an interpretation method that uniquely situated my skills as strength for this study. For one of the first times in my life, my learning style, often described as too abstract and usually with too much

overthinking, became the tool that I feel in the end allowed me to arrive at my conclusion to a topic that has been on my mind in various ways for over 20 years. As such, I believe that this study evolved into a natural movement from top-down to bottom-up thinking in which I was finally able to make connections within the data that others may have missed.

Use of the Literature in the Research

The ways that grounded theory studies use existing literature are contested between the leading theorists (Mills, Bonner, & Francis, 2006). As originally proposed by Glaser (1992), traditional grounded theory intentionally avoided the early review of literature to prevent contamination or inhibition of ideas and thoughts. However, Strauss and Corbin (1990) proposed that early and deep engagement with the literature could give foundation to the inquiry. Others have even suggested that the literature should be interwoven throughout the process and presented in such a way as to provide an additional data set to assist in the evolution of the theory and to give voice to the researcher's theoretical reconstruction (Mills et al., 2006). With these widely disparate views on the use of literature, I felt that a statement about how I used the literature in this research was imperative. As the reader can clearly see, I conducted an extensive literature review on my topics of interest prior to beginning the study. I felt I needed to do this to begin to understand the topics of my inquiry for their applicability to ASD. Therefore, Glaser's (1968) recommendation of research before literature was clearly removed from my selection of possibilities. Thus, I proposed a foundation for the inquiry using Strauss and Corbin's (1994) recommendation. But, as I explored further, I also found that I needed to do more than rely on what I knew thus far; I also needed to return

to the literature to explore topics that arose in the data as I began to formulate my theory. Finally, as my theory emerged, I found that I needed to consider what was being researched in the field of discrimination for both memory and sensory processing in addition to the broader research on memory, in general, to fully understand the emerged theory. In so doing, the final product included literature as both foundation and as additional data source and voice in the research and the proposed theory that emerged. Therefore, I most closely aligned with the use of literature that was proposed by Mills et al. (2006).

Trustworthiness, Validity, and Reliability Procedures

Merriam and Tisdell (2015) suggested that as qualitative researchers strive to answer questions in ways that are able to bring deep meaning and understanding to certain conditions or situations, they should always be questioning whether or not they got it right; whether their accounting is accurate, and if it is even possible get a *right answer* in the inquiry. To do this, Merriam and Tisdell (2015) proposed that researchers must consider their own views, the views of the research participants, and the views of those reading the research to determine if their studies are valid, if the data are reported reliably, and if the research is of high quality. Using terms that are often unique to the qualitative research tradition, Merriam and Tisdell (2015) proposed several important strategies that must be employed within a qualitative inquiry to assure trustworthiness, validity, and reliability.

As the first of these, Merriam and Tisdell (2015) indicated that prolonged engagement between researcher and participants is necessary to establish trust, understand cultural differences, check for misunderstandings, and negate distortions

introduced by the researcher. Simply put, qualitative studies take both time and engagement. For this study, I intended to meet with and record interviews that were at least 30-45 minutes in length with each participant; then I followed up with the participants several more times, as needed, to ensure that I understood the data and to determine that the data were fully saturated (Charmaz, 2014). However, I found that my need for prolonged engagement was seriously underestimated in my proposal and instead of 30-45 minutes, my initial interviews often took an hour, with more than half requiring a second follow-up of another 15-30 minutes. Once the open-coding procedure was completed, I engaged again with some of the respondents through e-mail exchange, asking most several questions that likely took another 10-15 minutes for them to answer. With five of the participants, I then found that following the open and axial coding procedures as the data and relationships emerged, I needed even more time to verify my findings and my interpretation of them. Therefore, in a final stage of data collection, I exchanged ideas and gathered additional information and insight from five of the participants which required an additional 20-30 minutes with each.

Stake (1995) proposed that validity in qualitative research, like "celestial navigation" (p. 109), is gained through triangulation. Merriam and Tisdell (2015) indicated that triangulation is achieved through the combining of multiple methods, sources, investigators, and theories. To this end, I addressed trustworthiness through the (a) triangulation of full and detailed self-disclosure of my researcher's stance, (b) member-checking the data and the assumptions with several of the study's participants, and (c) through the reporting of all data using *thick rich description* and direct quotes as much as is possible. As often as was appropriate or possible, I also included the exact

words of the participants within my final narrative. Finally, I added a reliability checking procedure with three professionals (one, an author and professor in special education specializing in autism; another, a well-known consulting psychologist in the field of autism; and the third, a national speaker representing the non-vocal aspects of ASD). All three were also themselves diagnosed with autism.

Next, the never-ending role of articulating my own biases as researcher became yet another of Merriam's and Tisdell's (2015) critical validation strategies. Within my research proposal I attempted to frame the study and provide a few key pieces of my background for their relevance to this research. However, as the study evolved, I found myself needing to do much more than articulate and clarify the biases that emerged; as I undertook this inquiry, I needed to analyze them. More specifically, I found that my marriage to my first husband, who I have always considered to be somewhere on the autism spectrum, my own quirky visual learning style, and my relationship to several immediate family members who are likely on the ASD spectrum themselves became worthy of disclosure. In addition, I also learned that much of what I had been taught in school about autism needed to be seriously re-considered for me to understand the condition from the perspective of those diagnosed. Specifically, for those on the spectrum, comparison to some developmental normal seems neither fair nor accurate.

As a lone researcher, the study becomes reliable only through the ways and means by which I collected and interpreted the data. Merriam and Tisdell (2015) have proposed that peer review and debriefing procedures should be employed to validate research findings. Without formal research associates on this project, I hoped to utilize the time and talents of my doctoral research committee members to both support the reliability of

the study (how I coded the data and drew meaning from the data) as well as to validate the research. Luckily, as I progressed, I also drew the attention of a two interested experts in the autism community who were diagnosed with ASD themselves, and they provided me with much-needed reliability checks for my theoretical understanding and interpretation of my data (Lincoln & Guba, 1985). Thus, while my committee was willing to offer more supports, by finding those diagnosed with autism who also had doctoral degrees to help me in what evolved through a peer-review process of sorts, I found much insight and wisdom that I was able to apply to my theoretical conclusions. As this study was conducted as a doctoral dissertation, the *external auditing* for the research was well-directed by my doctoral committee and the University of Northern Colorado Graduate School.

Research Permissions and Ethical Considerations

According to Creswell (2013), researchers must address issues pertaining to permissions and ethics in their research within each of six distinct stages of the study; these must include "prior to conducting the study, at the beginning of the study, during data collection, in data analysis, in reporting the data, and in publishing a study" (p. 57). Within each of these stages, Creswell (2013) identified several different types of ethical issues that can occur. With Creswell (2013) as my guide, I have detailed, by stage, the potential ethical issues that I anticipated in this study and how I addressed these issues during the course of my research.

Stage One: Prior to Initiating the Study

At this stage, Creswell (2013) reported that such things as university and professional organization approvals as well as site-based issues and authorship details must be addressed. For this study, I requested and received approval to conduct research from the institutional review board (Appendix A), and I sought permission to recruit participants through the USAAA's weekly newsletter (Appendix B). As this study was solely my own, conducted as a dissertation within the University of Northern Colorado, there were no issues with authorship.

Stage Two: At the Beginning of the Study

As the researcher begins the study, Creswell (2013) recommends that the full purpose of the study be disclosed, that participants be sought respectfully and without pressure, and that the needs of vulnerable populations be addressed. Within this directive, I announced and disclosed the full purpose of this study in the USAAA conference newsletter on three separate occasions. Using only the recruiting flyer (Appendix C), once participants contacted me by e-mail to show interest in the study, I thanked them for their consideration, and I provided them with a consent document. After the consent document had been signed, I scheduled the participants for a telephone or Zoom Conferencing Software interview and sent them a copy of the questions by e-mail. Finally, after advertising with USAAA's newsletter on three different occasions, I put out a general call for participants using my Linked-In and Facebook accounts.

Stage Three: Data Collection

During data collection, researchers are charged with the tasks of being respectful, ensuring that the data are collected without disruption, conducting interviews that are free from exploitation and/or deceit, and ensuring that the participants are not *used* (Creswell, 2013). In this aspect of the study, I attempted to build trust with the participants by engaging with them in an open, active dialogue that was respectful and confidential. To ensure that the participants understood the study completely, I initiated the interview by once again explaining the study and reminding them of their rights as confidential participants. Within my questioning, I refrained as much as possible from the use of leading questions or from pressuring participants to respond in a certain way.

Stage Four: Analyzing the Data

During data analysis, Creswell (2013) suggested that ethical issues emerge when researchers disclose only those results that are in alignment with the research questions, when the analysis sides with the participants, and/or when the privacy of personal or sensitive issues is improperly disclosed. With these ethical issues in mind, I made every effort to analyze the data from the methods proposed in the methods section of my study, and I reported the data in such a way as to be inclusive, appropriately distanced, and properly respectful of personal and private issues (Creswell, 2013).

Stage Five: Reporting the Data

In reporting the data it is imperative that researchers refrain from falsifying data, misrepresenting the authorship of data reports, plagiarizing any portion of the report, and improperly disclosing information that could potentially identify or harm the study's participants (Creswell, 2013). While the first of these seemed apparent at the outset, I

needed to be especially cognizant of the last because I ended up interviewing several individuals who disclosed either very personal/explicit information (sexual in nature) or very public information that could potentially identify the participant to others within the autism community (i.e., references to books or published articles). In all cases of either explicit or openly public information, the data were omitted.

Stage Six: Publishing the Study

Creswell (2013) concluded with several ethical considerations pertaining to the publication of the study. For this, Creswell's guidance was in line with the research requirements for publication of a dissertation at the University of Northern Colorado.

Setting

The setting for this study was my home, where I recruited participants through an online newsletter from one of the nationally recognized organizations serving those with autism, the United States Autism and Asperger Association (USAAA), of which I am a member of its community advisory board. USAAA was founded in 2005 and since its creation, the organization has delivered a weekly newsletter and hosted nine world conferences and expositions, with approximately 750 participants in attendance at each. According to the USAAA website, the organization's mission is to

> Provide the opportunity for everyone living with autism, Asperger syndrome, and other related disorders, to achieve their fullest potential by enriching the autism community with education, training, accessible resources, and partnerships with local and national projects. (USAAA, 2014, p 1).

The organization boasts affiliation with a large network of world-renowned professionals who have expertise in autism, Asperger syndrome, and other pervasive developmental disorders. The one thing that sets this particular organization apart from other autism training organizations is, however, is that 10 of the 12 members of its research and

advisory board are themselves diagnosed with autism; the organization also calls as speakers a large number of adolescents and adults who are themselves diagnosed to be on the autism spectrum. This heavy focus of content presented from the perspective of those with ASD often brings individuals diagnosed with ASD to this particular conference over other autism conferences. In addition to in-person attendance, USAAA was the first of the national autism organizations to offer live- streaming of its entire conference online. This resulted in 34,000 viewers logging in from their personal computers world-wide, making this particular conference the largest autism-specific conference in world history. It is suspected that a large number of those viewing the conference online were themselves on the autism spectrum.

As the primary data source for this study, I chose to gather data on the proposed research topics through a recruiting flyer published in the USAAA's weekly newsletter. Thus, the setting for this study was my home, using telephone and online telephone conferencing tools to conduct the interviews with affiliates of USAAA. This method gave me 12 initial volunteer participants. However, after the flyer ran in the newsletter on three separate occasions, I also found it necessary to post the recruiting flyer on my own social media sites, which included Facebook and Linked In where I asked my friends and professional colleagues there to share the same flyer that I used with USAAA. Through these connections, I was able to recruit an additional three participant volunteers.

Participants

For this inquiry, I intentionally selected participants from the network of attendees and affiliates of the USAAA who were diagnosed or self-diagnosed to be on the spectrum

of autism. Given this reliance on self-identification for the conditions of autism, I neither verified nor disputed diagnoses for any of the participants, but instead, relied on their self-alignment with the diagnosis as a condition for inclusion in the study. This obviously delimited the study to those individuals who were self-identified. To initiate the study, I introduced the research and put out a call for participants at the USAAA conference's opening session and in the conference newsletter. Then through a five-month process, I conducted interviews with adults diagnosed to be on the spectrum of autism, using both telephone and computer conferencing technologies (the latter was found to be necessary, given that three participants did not live in the United States).

The participants who volunteered for the study (both the initial 14 participants and the 3 expert professionals) included 12 men and five women. Their ages ranged between 21 and 63. In the volunteer sample, I successfully recruited participants from 12 different states within the United States and from three countries that included Ireland, Morocco, and Australia. Of the participants who volunteered, several had co-existing conditions and learning disabilities, with the most severe of these also blind from birth.

The participants reported being at varying stages in their educations, careers, or vocations, and two were listed as permanently disabled although both of these also held part-time jobs. The vocational range of those in the study included entry-level employment or educational pursuits such as full-time student, food-service attendant, telephone operator, airline stewardess, and home-health caretaker. Advanced training careers for those in the study were reported as computer programmer, professional photographer, university professor, professional speaker and lecturer (on the conditions of autism), and one even held a high-level position within foreign affairs. Among those

considered to be expert professionals, all had published books or articles and/or they had spoken at national conferences on the topics of autism. Within discussions about careers and vocations, it was interesting to note that several of the participants had held higher-level or higher-paying positions in their past, but had been forced to resort to work in more entry-level positions for their long-term survival and success.

Of the 17 participants (14 initial and 3 expert professionals), 4 were married (1 now divorced), and 3 of them had children. The rest had chosen to remain single. The study included 1 transgendered individual and 1 individual who identified himself as a homosexual, although gender orientation and sexuality were not questions specifically asked; therefore unless offered, those data were not formally gathered. Only 1 of the participants (1 of the expert professionals) considered himself completely non-verbal (approximately 100 or so words in his spoken oral vocabulary) although he was clearly capable of communicating through typing.

Because I specifically asked about diagnosis, I learned that of the 17 participants, 4 were diagnosed to be on the autism spectrum as children, and the remainder had been diagnosed as teenagers or adults. The rate of diagnosis for Asperger syndrome versus autism was higher in this group (10 to 7) than is seen in the general population. The diagnosis of Asperger syndrome or autism was also aligned with the years in which the diagnoses were given.

Of interest to this particular inquiry, I also explored how much information the participants had about existing theories that have attempted to explain cognitive differences in autism. Of the 14 initial respondents, only 4 of them had heard of the existing theories, and these 4 aligned themselves with either theory of mind, the intense

world theory, or both (2 for theory of mind, 1 for intense world theory, and 1 for both). One of those who knew a great deal about theory of mind was adamantly opposed to it, although he conceded that he did have some difficulties reading body language, especially when there was something going on in the background. Several also mentioned the theory of executive functioning as it related to their challenges with multi-tasking, but none seemed aligned with it in particular. None of the participants seemed to know about the ideas proposed for the weak central coherence theory. In further discussions with these participants about the existing cognitive theories, all had only a very limited understanding about the existing theories. The 3 expert professionals, however, had all researched the primary cognitive theories within their line of professional experience, although even they seemed to know only basic information about the theories and their differences. One of the participants explained the reasoning why those with ASD are not that familiar with the prevailing cognitive theories by stating, "My wife would know all about them, but when you are living in the trenches, it is kind of a waste of time to wonder how those who don't have it have tried to explain it."

Although this study could have possibly gone on for much longer, and the interviews only scratched the surface for a multitude of topics introduced outside of this particular inquiry, because each of those who volunteered had very unique attributes and stories, I gathered data primarily on the proposed research topics until I felt like I was hearing the same things about the research topics again and again. Clearly, this study opened up a much wider range of experience and insight that the participants shared; but by focusing on the topics of cognition, intelligence, and sensory processing, I was able to achieve what I felt to be a comfortable level of saturation for this study. Using the

methodology described, I also arrived at a place where the central themes of this research inquiry, although not the entire condition of autism, seemed fully saturated. To achieve saturation, however, I did find that I needed to contact several of the participants two, three, and even four times for discussions after the initial interviews.

As a convenience sample and within the proposed selection procedure, both the setting for the initiation of the study and the selection of participants as affiliates of the USAAA organization were certainly not typical. However, I was specifically interested in the unique perspectives of this particular group of participants for their chosen affiliation with USAAA. Given my experience with USAAA, I anticipated that the majority of those who volunteered to participate in this study would be fairly high functioning, obviously able to read, and for the most part, verbal.

But once I began recruitment, I was contacted by eight different mothers of sons and daughters with ASD, volunteering their young adult children for participation. This led to a series of conversations with those mothers in which it became clear that they felt their offspring were highly intelligent, although they were entirely non-verbal. In these discussions, I soon learned that these moms hoped I was working on figuring out a way to capture the intelligence of their non-verbal sons or daughters. This forced me to modify my recruiting flyer to specify that a method of communication (speaking or typing) was needed for participation. The study did not include as participants those who were solely dependent on others, such as parents or therapists, for their voice facilitation (in this way I eliminated the biases of outside communication facilitators); although in hindsight, had I found a way to consider those who were very close to their facilitative communicators, I might have been able to give a greater degree of voice to those on the

spectrum who are non-vocal. Near the end of the study, I did find one additional expert professional participant who considered himself entirely non-verbal, although he was able to communicate effectively through type/text technologies, and he weighed in as the last expert professional on the data and my interpretation of them, lending some additional insights and fine-tuning to the proposed theoretical model.

Of the participants included and for those who preferred to type their responses, I delivered the questions by e-mail, then allowed them to type and return their answers to my university e-mail address. Once typed responses were received, I excluded all identifying information for those participants and then combined those responses into the data set that held the transcripts of those that were interviewed. For follow-up interviews and the interviews of the expert professionals, because all but one chose to type their responses, I copied their data directly into my open-coding data document, thereby organizing it as it came in.

Data Collection

To initiate this study, I announced the purpose and intent of my research in the USAAA weekly newsletter on three separate occasions for the actual recruiting flyer (Appendix C). Near the end of the study, I also put out my call for participants on my online social media websites. Once initiated, I provided consent documents via e-mail to the volunteers and offered to answer any additional questions they might have prior to asking the research questions. Once consent was received, I scheduled interviews through Zoom, an online telephone communication system, or I sent the questions online for those who preferred to type responses. All of the online telephone communications were audio-recorded within the Zoom online recording feature, and the interviews were

transcribed using the Transcribe app for windows (https://transcribe.wreally.com). Before I began the study, I anticipated that each interview would last approximately 30-45 minutes, but as the interviews occurred, I found most lasted closer to an hour. In each individual interview, I posed several topical questions (Stake, 1995) to open up discussions about the lived experiences of the participants as they pertained to my research questions. The actual questions asked and/or delivered to the participants for written response are included in Appendix D.

Once the initial interviews were conducted, I transcribed the recorded interviews and then began to sort and code the data. If needed, after the initial interview, I re-interviewed the participants via e-mail question or Zoom. Nine of the 14 initial participants responded to follow-up interviews that lasted 10-15 minutes. This helped me to gather additional data and clarify emerging themes. Once this step had been completed, I found that I needed to communicate again with four of the participants for clarification to more fully understand statements that I felt were critical to the emerging theme of the research. In these, I e-mailed my specific questions, and some of these went back and forth several times until I felt like I fully understood the comments that had been provided. Then, for a final time, I worked with several of the participants on the construction of my theory for this research. Finally, once the data collection and analysis procedure was complete, the data on the primary research topics felt fully saturated, and the themes and theory for the inquiry were fully evolved, I recruited three additional participants with ASD through my network of referring professional to conduct a discriminant check for the theoretical construct proposed within this research. These

interviews were not recorded, although I took notes and transferred that data as well into the final selective coding transcript.

Data Analysis

I followed coding stages for data analysis as recommended by Charmaz (2003) for specificity to my own theoretical frame and the use of a grounded theory research approach. The sequential detail for the data analysis for this research is articulated in the following sections.

Initial Open Coding

According to Strauss and Corbin (1990), within a grounded theory study, the first stage of data analysis begins with open coding; at this point, data are broken down, examined, compared, conceptualized, and categorized. Strauss and Corbin (1990) added that in the open coding stage, all data must be considered outside of any *preconceived notions* so that the researcher can allow for the natural emergence of conceptual categories that will later lead to theory.

Within an open-coding structure, as the initial 14 interviews came in and were transcribed, I read and re-read them on multiple occasions to examine them for similarities, differences, and patterns. As I did so, I also began to make comparisons, form questions, and take notes—first, in my researcher's notebook and later, directly into my working document using Microsoft Review.

Once the initial data were collected and merged into a single file, I color-coded the responses by participant and saved that file as "Raw Data File." Then I copied that file and using headings in Microsoft Word, I divided the data into 52 open-coding categories and named each, placing each data set relating to a particular category under a

category heading and into alphabetical order for easier location. Using this process, I was able to cut, paste, and move all of the raw data into one of the initially open-coded categorical sections (Glaser, 1978) titled, "Open Coding Sets."

In the open-coding stage, I also began to create images and diagrams in my mind in an attempt to visually represent the coded categories that were emerging out of the open-coding procedure in order to understand how they related to one another (Huberman & Miles, 2002). These were noted in my researcher's notebook. In my results, I include a list of the 52 categories that came out of the open-coding procedure.

Axial Coding

Once all of the initial 52 categories had been identified, I went into each category and summarized the content within, retaining actual words as much as was possible, using Microsoft Review. This allowed me, in essence, to begin to understand the categories more completely and gave me the ability to start to compress the data into the main ideas within each category.

Having done this, I found that I was still a bit overwhelmed by the data. So I used a Microsoft WordArt feature to visually group some of the categories by their relationship and association. This helped me to see the data, which in turn, helped to clarify the relationships within the categories. From there, I also first began to understand and establish some of the theoretical links between them (Glaser, 1978). This process left me with a single foundation category and five primary categories that were supported by three to five additional supporting categories each. For all five of these categories, I also found that I had an "effects of" category which I ultimately used to assist me within my axial coding procedure. With the five primary categories

established, I returned to the body of evidence-based literature to understand whether the primary categories that were emerging were in alignment with the literature. I found that three of them were well-reflected, but the other two, while discussed, did not appear to be fully researched. This required me to look up several new studies that pertained to some of the emerging themes to verify that there was at least some basis for them in my data. At this point, I also began my search for three expert professionals (individuals within my network of colleagues who were both experts in the field of autism and themselves diagnosed with autism) for the purpose of verifying the primary categories and to gain support and insight into how the categories might interact with one another.

Using the newly coded axial-data, my SmartArt images, and my literature review, (Trochim & Donnelly, 2001), I finally started to understand, both inductively and deductively, some of the relationships in the data. With these coming into more clarity each time I went through them, I was able to further narrow and condense the data. At this point, I also began combining ideas and deleting repetitious commentary, which left me with a file that was just under 30 pages of quotations, by category, which I titled "Axial Coding Sets." From these, I drew nearly all of the statements I put forth in the reporting of my axial-coding procedure.

Selective Coding

For the third stage of analysis, I again used the same recursive techniques as those used in open and axial coding, albeit with a higher level of abstraction, to integrate the categories and to help me determine the central or *core process* for the categories (Strauss, 1987). Starting with my axial-coding categories, I began to consider relationships and potential and intervening conditions (Corbin & Strauss, 2014). Using a

recursive process, I went through the data in my mind, moving back and forth between the open- and axial-coding procedures using both an inductive and a deductive mode of thinking, to confirm that the primary categories could be confirmed and grounded within the actual data, to ascertain whether the data concepts had been fully saturated, and to consider the data within the context of the evidence-based research (Corbin & Strauss, 2014). In this stage, I also found that I had several additional questions for the initial participants, so I contacted 5 of the initial 14 participants to discuss my preliminary finding with them. By going back and forth, I was able to order the categories in a way that made sense for reporting. I also considered what I had originally found as the *effects of* for each of the five primary categories, and as the "effects" emerged within a selective-coding process, I was able to winnow the data down to the primary categories, the effects of each, and the statements supporting their relationships, one to another. With these steps completed, I then interviewed three expert professionals to ensure that I was on track with the themes, relationships, and my still-emerging theory. Following the interviews with the expert professionals, I went through the data yet again and highlighted what I felt were the most significant statements to support outcomes for each category and to tie the categories together. This evolved into a final understanding about the process of the data.

Once the core process emerged, I detailed (again through the use of theoretical memos) an elaboration of how my theoretical understanding to support my "Cognitive Theory of Difference" came into being. This required me to consider both the essential properties and relationships to the lessor categories and to re-think the core categories, their supports, and their processes for what I refer to as the emerging theme of the data.

Finally, within this last stage of selective coding, once the core category processes and relationships emerged, I reconnected with two of the three expert professionals again and collected additional new data, using a process of *theoretical sampling* (Charmaz, 2003). With several clarifying questions, I approached several initial participants on more than one occasion until I reached the point where I was able to conclude (a) that the data were reasonably complete; (b) that the core features of the data had been fully saturated and detailed within the participants' responses; (c) that the foundation, primary, and secondary categories had fully emerged; and (d) that the processes and themes for the data, along with their relationships, were supported and clearly depicted. Once this was finalized, I returned to one of my expert professionals a final time to verify my findings and solidify my thinking. This process allowed me to finally visualize and piece together a diagram as well as articulate it. I include both the diagram and my articulation of it in Chapter IV.

CHAPTER IV

RESULTS

Procedural Summary

In this study, I interviewed 14 initial participants plus three expert professional participants (diagnosed with autism and also working professionally in the field) across an approximately six-month time period to acquire a rich, 300-plus page set of transcribed data. Once collected, I analyzed the data using a grounded theory methodology, in which I evaluated, interpreted, and compiled the data within the lens of social constructionism. Within the first of a three-stage process, I arrived at 52 initial, Open-Coding categories. These were able to be condensed, using an Axial-Coding process, into one foundation category and five primary categories that were supported by three to five secondary categories each. From there, using a combination of inductive and deductive reasoning, ties to my literature, and with the help of the initial participants and three expert professionals, I recursively examined the data, using a Selective-Coding procedure along with data that I had determined were essentially the 'effects of' for each of my primary categories, until the processes, relationship, theoretical conclusions, and main theme for this study emerged. Finally, once the main ideas of the study had presented themselves, again with the help of several initial research participants and two of the three expert professionals, I was able to articulate the evolved theory, ask new questions, and arrived at what I felt was my strongest and most complete theory for the

data. With this established, last I envisioned a theoretical model that I felt visually captured the essence of this data and the findings of this research, and I created an articulation statement that summarized my visual model.

While it is customary for the reporting of data in qualitative studies to combine a variety of researcher-as-author reporting of the raw data, as well as cumulative writing by the researcher, I chose to use the participants own words as much as was possible, to provide what I believe to be the clearest picture about how the data evolved into the resulting conclusions. Therefore, to honor the rich and descriptive nature of 'voice' for those who participated in this research, I begin with a quote from one of the participants.

> Before we start, I have a tip for you. If you talk to a lot of people like me and what your hear sounds 100 percent wrong, but you keep hearing it over and over, the fact is, it probably isn't 100 percent wrong (Participant VII).

Participant Details and Contributions

Within studies of this type, the researcher's primary role is to gather, sort, combine, construct, and articulate the shared ideas that emerge between the researcher and the participants during discussions about the research questions. However, because the data are then combined into what ultimately results as a "shared dialogue," the individual participants along with the individual unique ideas and contributions that each gave to the study often become lost within the reporting of a combined narrative of results. Therefore, to give some level of individuality to the participants without disclosing any identifying details, I have chosen to open the results of this research with a brief description of each participant along with some of the primary, main ideas that I drew from each. The breakdown of ideas by participant in their order of recruitment

(which was not necessarily the same as the order in which I conducted the interviews, especially as this related to the expert professionals) follows.

Participant I

Participant I was the first to respond to the call for participants sent out in the USAAA Newsletter. This participant resided in Ireland, was diagnosed as an adult, and currently worked as a home-health assistant for a woman with physical disabilities. He had professional training and work experience in the computer science field, but when working there, found that due to sensory overload and social challenges, a professional career in that field was not sustainable for him. The participant was unmarried and diagnosed with Asperger syndrome. He brought to the study a number of ideas about how computers might be likened to the processing differences seen in ASD, how different "modules" of information processing might be at work for those on the spectrum, and the idea that autism as an evolutionary condition might, in fact, be useful for the human species.

Participant II

This participant was referred to the study by his vocational therapist who saw the ad in the USAAA Newsletter. He was middle aged, married, and had several children who were also diagnosed with ASD. He, his wife (who was physically disabled), and several of the children lived in the midwestern portion of the U.S. where part-time work supplemented by disability income provided the family with a meager living. This individual was diagnosed first with schizophrenia, but then later re-diagnosed as gifted and on the spectrum of autism. When he was able to work, this participant, like the previous one, worked primarily in the fields of computer science and engineering. His

contributions to the study, in line with his background in computer science, offered the idea that those with ASD have a different sensory system (much like an eight-lane freeway system) or bus port on a computer and that this, in turn, alters what is remembered and learned. This participant also shared views about what he described as "injury" in ASD and/or an extreme visual learning style for those with ASD who are non-vocal.

Participant III

Participant III was a young man in his early 20s who was diagnosed with Asperger syndrome as a youngster. He worked as a stewardess for a major airline carrier and claimed that his early supports and educational opportunities taught him how to deal with his sensory issues so that he didn't become so easily overwhelmed. In his interviews, he shared a great deal of specificity about different types of sensory-based challenge and how these contributed to issues with processing speed. This young man also suggested that high intelligence and increased sensory processing might be aligned. This particular young man was also openly gay and shared his insight about how social difficulties had played out for him through the years.

Participant IV

The fourth participant, also recruited through the newsletter, was a woman who was in her late 50s. She was currently living in Morocco (as she said, to learn Arabic) and held a high position in foreign affairs. Although married as a younger woman, she was now divorced and had two young adult sons, both identified as being on the autism spectrum as well. One of them seemed to be very high functioning, while the other had more impairment. This participant, in spite of her high ranking at work, reported that she

needed a lot of support to help her manage her position and her home. When detailed, these supports appeared to include very specific directions for how and when she was to interact with others within the working environment. Unlike the majority of the other participants, this individual brought to the study a number of insights about extreme hypo-responding, particularly to certain sounds and/or blinking lights to the degree that concerns about safety were considered. This fourth participant also shared a number of ideas about individuals with ASD who think in pictures versus those who think in words as well as the idea that an ability to have hypo-responding within the sensory domain might allow for increased functioning in school and work. Suggestions about differences between men and women with ASD, differences in learning styles for those with ASD, and indications that visual memory can be very different than spatial memory were all shared by this participant.

Participant V

Another one of the women in the study, this fifth participant was also middle aged and was currently on an unpaid leave from a job at which she has worked for over 20 years for a major credit card company doing phone-based solicitations and customer service. In the past year, she reportedly became too depressed and run down to continue going to work. She responded to the call for participants through the USAAA Newsletter. Never performing well herself on standardized tests in spite of always being told she was very smart, this participant shared a great deal of insight about the role of assessments and the problems that these tests have for those with ASD. She also introduced the idea that for those with ASD, learning something new was not only more of a challenge than for those who are NT, but also that anxiety is the result of being

forced to learn something new that isn't interesting. In addition, a number of insights were given about what should happen in the workplace for those with ASD. Finally, this participant shared the idea that intelligence could not be measured for those with ASD. This participant did not complete the questions or participate through the duration of the study with any of the follow-up discussions because she felt too overwhelmed by her work to offer any more to the study.

Participant VI

Recruited by me through the USAAA Newsletter, this sixth participant was unemployed at the time of the study and was living with his wife and two children. He had most recently been employed at a university where he taught photography. During the course of this research inquiry, he was also taking interviews and hoped to again be working at a university by fall. His two children, both young, were also diagnosed to be on the autism spectrum. In addition to being on the spectrum, Participant Six also described significant learning disabilities that negatively affected reading and writing throughout his school years. This participant had served in the military prior to pursuing his passion in photography and shared numerous ideas about visual learning, sensitivity to lights and sounds, and the impact of autism in the workplace where he suggested that all adults could benefit from some of the respectful paradigms of interacting that are taught to those with ASD. This participant was involved as one of several who not only gave much insight about visual, visual-spatial, and learning style differences in ASD, but also helped to frame the study from the perspective of those with ASD to give voice to the idea that existing systems don't necessarily support individuals with ASD. As a very active and interested member of the study, this participant helped considerably in co-

construction and was interviewed on four different occasions where each time he gave perspective and insight to the emerging data and to how I ultimately interpreted them. In particular, his views on memory helped to establish that as a primary theme for the study.

Participant VII

The seventh participant in the study was also recruited from the USAAA Newsletter and was a middle-aged man (never married) who worked as a food-service assistant for a hotel chain where he managed a breakfast bar in rural Wyoming. In addition to his part-time job, he spoke regionally (often unpaid) on the topic of autism at schools, and he has published a short book about his life on the autism spectrum. His ideas contributed clarity about the significance of sensory differences in ASD and the role that stamina and energy play for continuing performance, and he shared much content on the concepts of wisdom and discernment for their role in increasing understanding about social difference for those with ASD. This individual also described in detail a number of school experiences that gave clarity to the evolution of social views and attitudes for those with ASD in this study and helped to distinguish the difference between verbal and visual memory for those with ASD. He participated both initially and in the follow-up discussions.

Participant VIII

Recruited through the USAAA Newsletter, the eighth participant was initially uncertain about her ability to be in the study because, in addition to her autism, she was also congenitally blind. However, after working out a modified way for her to show her consent and answer the questions (she preferred to have the questions sent to her so she could respond to them using her own adaptive technologies to type responses), she

weighed in on the research topics both initially and through email exchange during follow-up interviews. This young lady was a full-time college student pursuing a degree in computer programming. In the study, she introduced discussions about synesthesia (the spillover of one sensory experience to another), insights about the cognitive basis for visual-sensory learning styles (in spite of being blind), and the idea that visual-sensory learners might have more sensory issues than the verbal-facts people with ASD. Her ideas were verified by a number of the others in follow-up, but it was this participant's unique line of thinking about learning style that essentially evolved into that highlight of the study.

Participant IX

The ninth participant responded to a post I placed on social media calling for additional participants in the study. Her mother and I had worked together in the past and in speaking with this participant, I got the impression it was her mother's idea for her to be in the study. Given that my professional circles had crossed for years with her mother, I had met this young lady prior to her volunteering to be in the study. She was in her early 20s, lived with a live-in support/roommate paid to assist her, and she was working. At the time of the study, this participant had completed her associate's degree, was working at an advertising agency, and hoped to go back to school for a bachelor's degree in some area within the graphic arts. This participant shared insights about her sensory difficulties, her issues with anxiety, and the role that obsessions and OCD had played in her performance. She also discussed her challenges with learning to drive a motor vehicle, which aligned with those reported by two other women in the study.

Participant X

A male living in Oklahoma, this tenth participant responded to the USAAA Newsletter and gave initial consent for participation, but then answered only the first three research questions before deciding not to continue in the study. His reason for withdrawal was that it seemed to be taking too long. Within the questions he did answer, contributions about the topic of "us" versus "them" (those with ASD and those who are neuro-typical) were clearly articulated, and these were included within the final reporting.

Participant XI

Participant eleven, a single older gentleman who was a university professor, answered the initial research questions, then also weighed in on several other ideas and themes that were emerging by this point in the study. Namely, he tied music to visual synesthesia and elaborated on the role of stamina and cognitive energy for implications to memory and attention. This participant responded to my social media call for participants.

Participant XII

The twelfth participant was referred to the study by one of the other members of the study and was immediately placed into the category of expert professional, based on his research publications and work in the field to support those with ASD. This individual disclosed that he was in his 50s, transgendered, and lived with his wife in Australia. He contributed much clarification about the relationships between memory and attention and the necessity of interest for attention and introduced the topics of object permanence as it related to memory, which greatly added to my ultimate understanding about difference in attention, memory, and cognition in ASD.

Participant XIII

Participant XIII was referred to the study by his mother who read the USAAA Newsletter. He sent in consent documents and answered initial questions via online written exchange, but then did not respond to any of the follow-up questions. With short, often one- or two-word responses to the questions, he contributed insight about some of his photographic memory abilities and his difficulties with the retrieval of spoken language. He also shared his feelings about being an outsider in what he reported as a rigged system.

Participant XIV

I recruited Participant XIV as a non-verbal, expert professional through my contacts with USAAA. He was a young adult who presented regionally and nationally at autism conferences, using assistive technologies. He was recruited specifically as an expert professional to help me ascertain whether or not the findings of my research were at all applicable to those who are primarily non-vocal and for additional insights about how the relationships between the primary and secondary ideas in the study had evolved. This individual added deeper understanding about the extreme nature of sensory difference, the narrow window of perfect memory, and confirmed ideas about his views on the "injured autistic" that were presented by earlier participants.

Participant XV

Participant XV was recruited as a third expert professional through my online social media contacts. As someone I had known through professional affiliation, this individual asked me if I would like to interview him to verify my findings and receive some help in putting my thoughts together. This expert professional was diagnosed with

autism as a child, was now a recognized expert in autism (both worked in the field and was diagnosed), and has written numerous books and articles. In addition to traveling all over the world to speak at conferences about autism, this participant was also a college professor in the field of special education. Nearing the end of the study, this participant confirmed and supported my findings thus far and helped me to see them for their relationship to social functioning. This individual also helped to verify the learning style aspects and clarified for the study an understanding about hyper- versus hypo-responding.

Participants XVI and XVII

Both recruited late in the study through lingering online posts and calls for participants, the last two volunteers, a man and a women (one from Texas, the other from the east coast), responded to some of the initial research questions and engaged with me in several discussions as I attempted to form the theory that eventually emerged in this research. The female participant (Participant XVI) added insights about memory and ties to emotion, while the final male participant (Participant XVII) contributed the idea of the church steeple (something he had learned from Temple Grandin, a well-known author and expert in the field of autism) for its implications in memory for those with ASD. Both participants also weighed in on and confirmed the primary categories that had emerged as well as shared their views to confirm that they believed the emerged theory from the study felt accurate to them.

Primary, Open Coding Categories

In quick review of the methods for this step, to arrive at the primary, open coding categories, I took my entire data set, which exceeded 300 pages of raw data (transcribed interviews and e-mails which had been divided into responses by question and color

coded by participant) and I slowly began sorting the data into themes. To do this, I first copied the entire data set into a word document. Then, I read each sentence and/or paragraph, and using a cut-and-paste process in Microsoft Word, I moved and organized all of the data into appropriate heading sections which were alphabetized. In most of the initial cases, I literally just moved the data from where it was in my original document into a newly themed section. However, as I worked through the data, I began to see repeats within the data structure. So, rather than copying and moving that data into the themed section (thus duplicating data), when there was commonality and overlap between the respondents about data in a particular theme, I combined the data, retaining the use of exact words for as much as was possible. Within this process, the first five or six interviews initially set the stage for about three-fourths of the categories to come. But as new interviews were added, I merged them as well, carried that new data over through all of the categories, and/or added categories until all of the interviews had been copied, combined, and relocated into one or more of the initial open-coding category themes. This procedure left me with approximately 150 pages of theme-coded data that I had broken down into 52 categories.

The original 52 Open-Coding categories that emerged from this cursory organizational procedure are listed below, in their alphabetical order:

> anxiety and stress; attention, concentration, and focus; interests and perseverations; auditory processing and communication; behavioral control; bullying; cognition, cognitive strengths, cognitive challenges, and cognitive energy; cognitive theories (alignment with); compensation and coping; consistency and change; coordination; diagnosis; discrimination; difference and

information processing; environment; executive functioning and multi-tasking; giftedness; higher education; injured autistic; information processing; intelligence and its measurement; interventions and supports; languages, English, and learning a foreign language; learning (core academic subjects); lighting, memory, non-verbal communication; object permanence; processing speed; performance; safety; social interaction; social compliance and group dynamics; school experiences; sensory processing difference and effects on performance; sexuality; sound sensitivity, awareness of sounds, and pitch; standardized tests; synesthesia; teachers; time; taste and smell; touch and texture; us and them; visual differences, strengths, and challenges; vocations and employment; whole person; wisdom and discernment.

Secondary, Axial-Coding Procedure

Using an Axial-Coding procedure, I worked to combine the categories. To do this, I read and reread each several times, made memos, then added additional commentary to my memos for each of the initial coding categories, using a Microsoft Review feature. At this stage, I once again tried to retain as much as possible the exact words of the participants; but because my goal was to condense and combine the data, without losing any of the important aspects, I found that I needed to find a better way to combine and visualize the data and to see relationships as the data and my memos were still too numerous and cumbersome to manage. So, to help me visualize my combining process, I employed a Microsoft Word SmartArt feature and this allowed me to group categories visually, which resulted in five primary categories. This process not only

helped me to uncover the primary categories, but also gave me the ability to begin to see some of the primary and secondary themes as they were emerging.

As the largest of all of the categories, it first became readily apparent that the topic 'sensory difference' could be combined, with all of the lessor categories pertaining to sensory processing, and these could then be placed into a single category, which I titled Sensory Difference. Once I had established all of the data links to sensory processing, I organized them using their headings, then extracted them and placed them into a new file. Figure 1 depicts the SmartArt image for the subcategories within sensory difference.

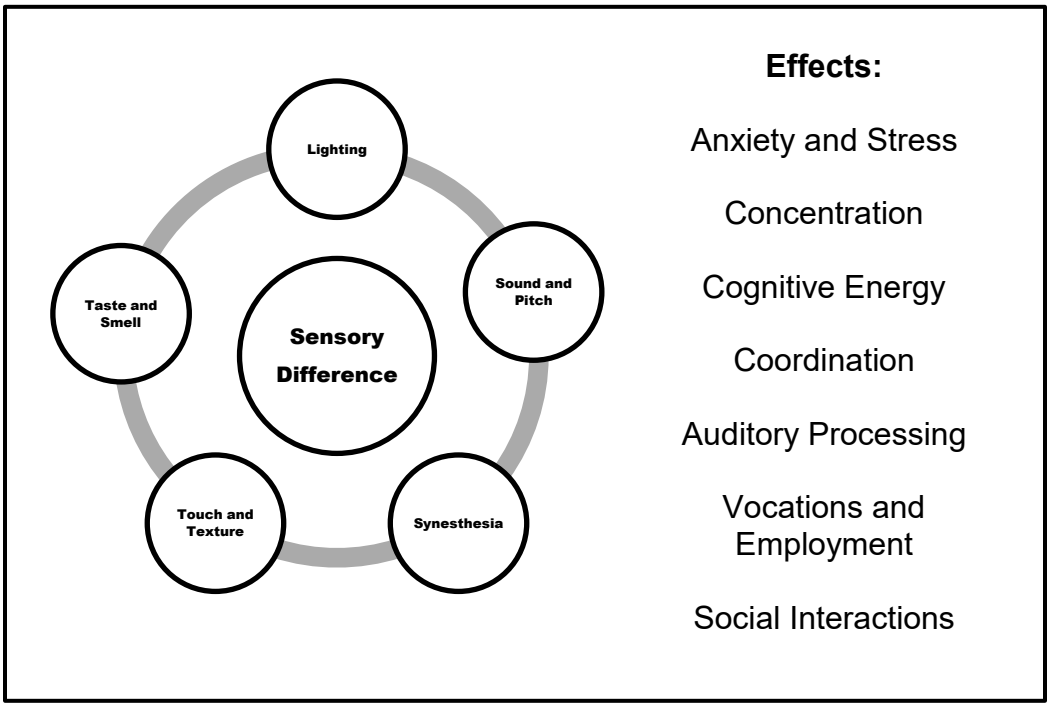

Figure 1. Sensory Difference

Next, I repeated the same process for the topics of memory, cognitive difference, and social interactions (I originally had a category which I called communication, but the more I understood that data, the clearer it became that the topic of communication fell

beneath both the categories of cognition and of social interaction). Figures 2-5 depict the emergence of the primary categories of memory, cognitive difference, and social interaction.

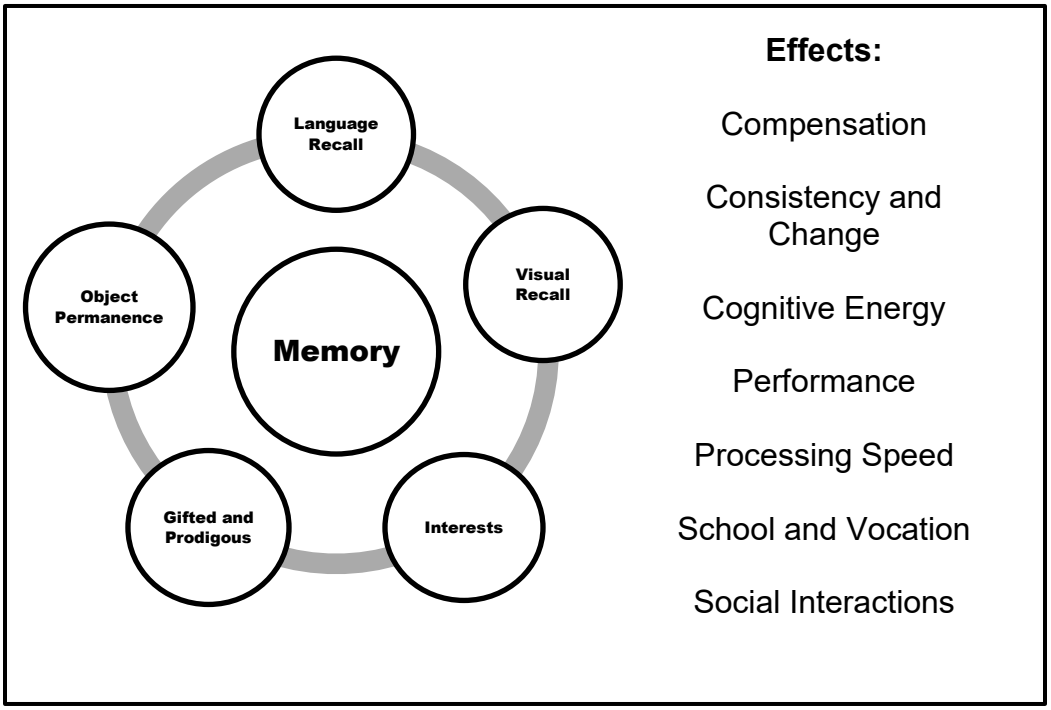

Figure 2. Memory

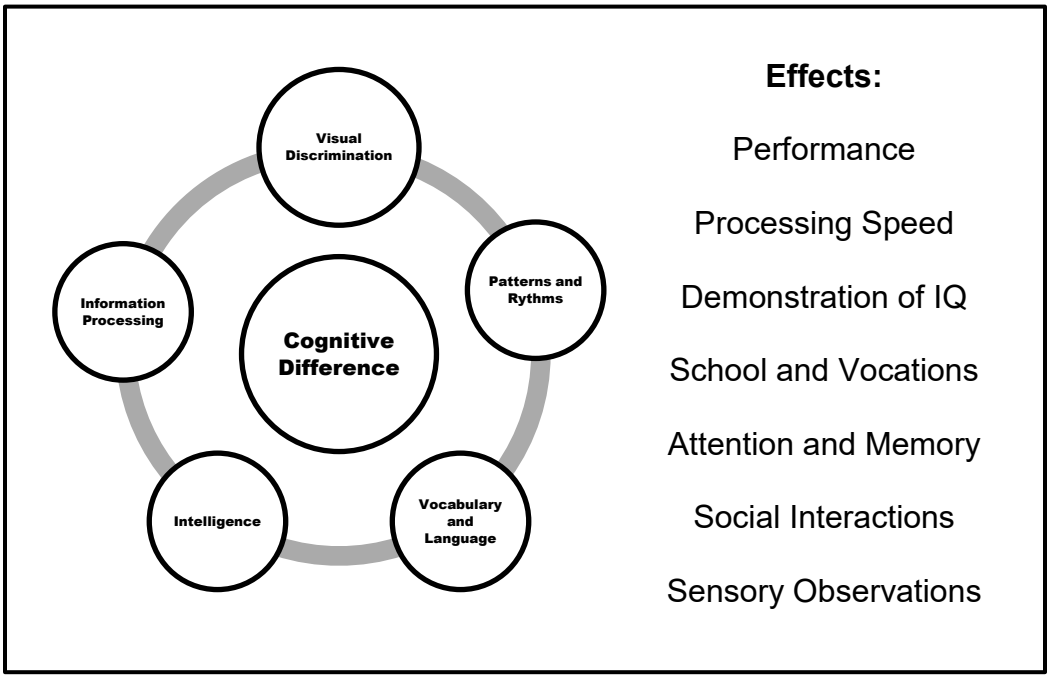

Figure 3. Cognitive Difference

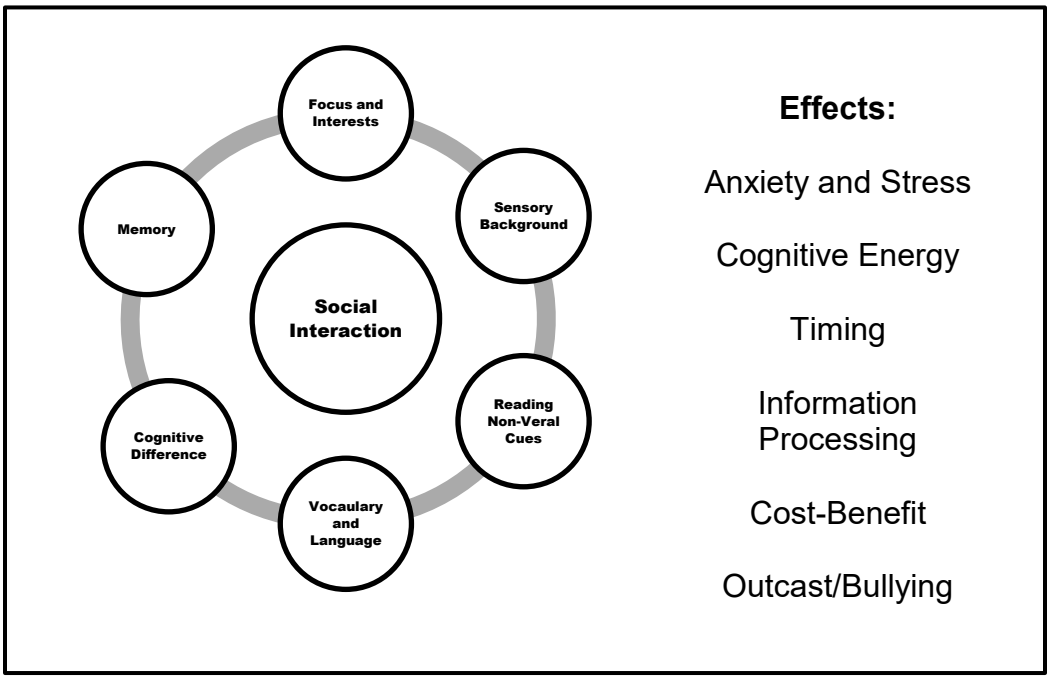

Figure 4. Social Interaction

But with these data compressed, extracted and moved into the new file, I was still left with a number of items, that in my mind seemed to be related to attention, as well as a fairly large number of unsolicited comments that seemed to not tie specifically to any of the other themes, but felt instead, 'wise and insightful.'

So I next created an attention category, but as that emerged, the data suggested that it was not specifically attentional, but rather a category that included ideas about focus, interests, and perseverations. After touching base about attention and focus with several of my participants, I resorted to the title of 'focus' as the most inclusive title for the data and as the last of the five, primary categories. Figure 5 details the components of this category.

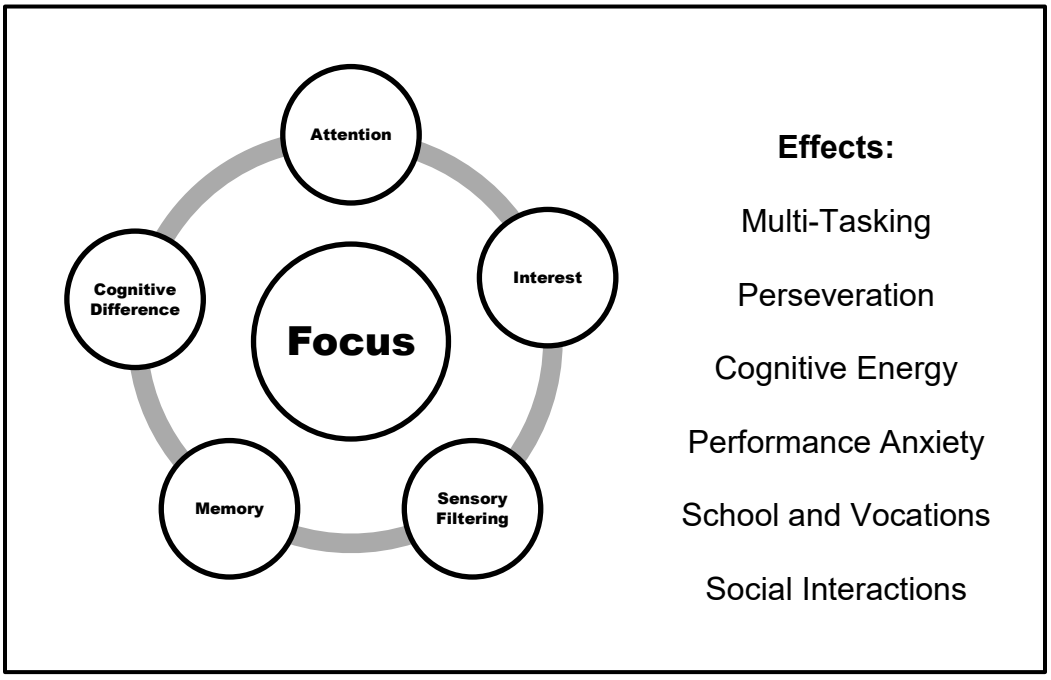

Figure 5. Focus

But left with still about 10 or more pages of 'wise' comments, I made the decision to combine these into a separate category that I finally decided served as a sort of

preamble, spoken from those with ASD, towards improving understanding about the data for those who don't have an understanding about autism. Once I combined these data, I realized they were indeed a Foundation Category that set the stage for understanding much of the data that were to come. Figure 6 shows these foundation items.

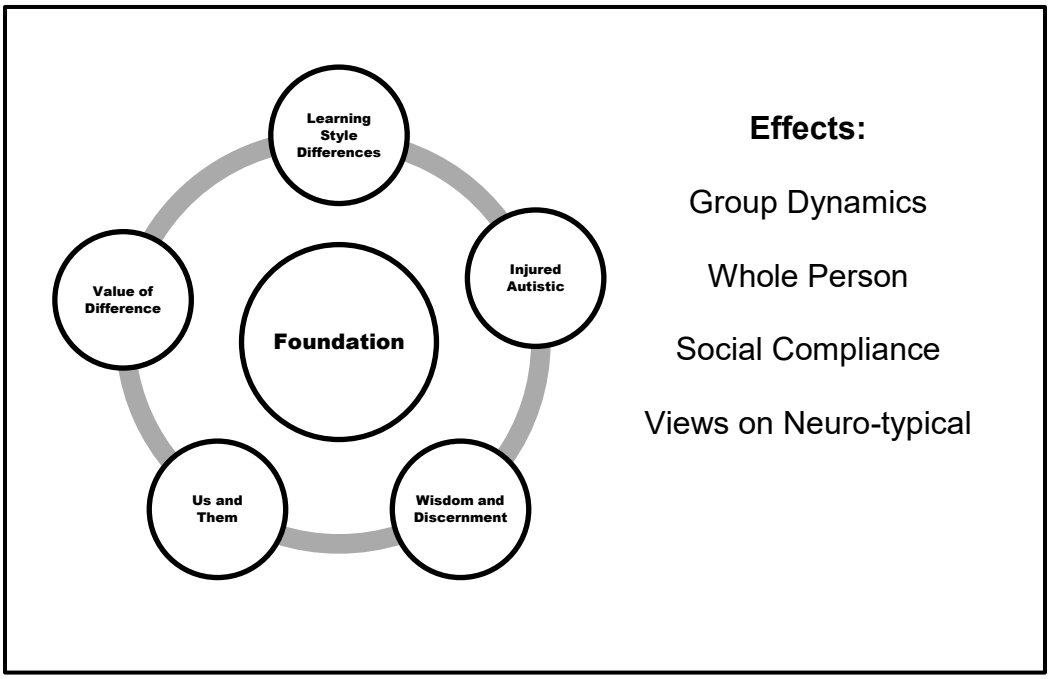

Figure 6. Foundation

With these images in mind, as I began the write-up of the data in this section, I initially included the effects within each subcategory. However, in so doing, I realized that I was writing much of the same thing, over and over, for each individual category. So in the end, I made the decision to separate out all of the 'effects' subcategories and combine them into a single grouping, which, in turn, set the stage for my third-stage, Selective-Coding procedure. As this evolved, similarly to how the foundation category had served as a preamble to the data, the 'effects' subcategory became the post-script that finally led me to my conclusions.

For the discussion of results that emerged from the Axial-Coding procedure, I have chosen to open with what I refer to as the "Foundation Category."

The Foundation to Understanding Individuals with Autism Spectrum Disorder

The foundation category, as I saw it, was comprised of the Open-Coding categories of: us and them, difference, whole-person, wisdom and discernment, and injured autistic. When combined, the contents within, both precede understanding for the formal data and give foundation to what many of those in the study felt about the research topics, but were not specifically asked to share within the questions. These, while not direct quotes, are a compilation of ideas, using as much as possible the exact words of those who chose to weigh in. These primary ideas have intentionally been left in first-person reporting to more accurately reflect the ideas of those who shared insights with me. Main points within the Foundation Category follow:

Wisdom and discernment. In the category of 'Wisdom and Discernment,' even before the category was fully formed and the data were still coming in, the topics of "you," as neuro-typical (NT) other, was compared to "us," as a group of individuals who share some aspects of sameness along the autism spectrum. This reminded me to truly listen and capture what was said, without using my "clinical ears," as much as was possible.

With that decision made, there was also the underlying sense that those in the study wanted other NT's to understand autism, particularly as it pertained to children, and for most, this reason alone was why they had volunteered. However with that came a fairly strong assumption that "while I can try to explain it to you, my thinking is so different from yours, you probably still won't be able to understand."

As my first take-away for the foundation section, I gleaned the idea that we (myself and those participating in my study) probably would not necessarily come to a consensus, but that our very different perspectives would ultimately be better than any single perspective. Moreover, that this combining of ideas would certainly be better than my own ideas alone, which were undoubtedly already entrenched in an inaccurate perspective of ASD, given my NT position and my clinical training.

Next, I came to understand, that those with ASD in the group feel like they have been forced to live in a non-inclusive system in which they often don't belong. A loud criticism of existing assessment systems, which compared those with ASD to those without, followed and this included the participants questioning my authority to even conduct a study on a population for which I am not a member. This was followed by the question, "Why can't we change the environment? It is what we need and society would do it for other people, if there really was some compassion for our disability."

Last in this section was a series of open criticisms of the NT establishment, for their lack of independent thinking and their cognitive disconnect pertaining to the topics of arrogance and needing everyone to be on the same developmental axis, as well as some preliminary definitions of intelligence. For the latter of these topics, the data were the results of a rather funny misunderstanding, where I posed as one of my questions, "What are your thoughts about intelligence in autism?," but the participant interpreted that to mean, "What are your thoughts about the intelligence of NT's from the perspective of those with autism?" Specific ideas, including as much as possible the participants' own words (although certainly not inclusive of all the ideas I used to form my opinion) follow:

- Unlike most (NT) people, I don't mind of we don't agree, I find that disagreement can be kind of helpful. Sometimes different perspectives can have validity and present a clearer picture.
- I would like to start by saying, I think the system is, well I'm not going to say rigged, but it doesn't work for people like us.
- In thinking back on my childhood, I feel like I was thrown to the wolves. We are processing everything very differently and we can't always figure out how to process what's going on. But, when you add to that hostility and aggression from others, sometimes even teachers, we start to really feel like we don't belong.
- It shouldn't be about what we can't do; it should instead be about each individual's ability, not some comparison to this big yardstick.
- I often think that it is a particularly autistic solution to the problem of a difficult environment to change the environment, rather than to change the person, but others don't see that as necessary.
- It is attention to a respectful paradigm that we need most. It seems like meeting our needs is too visionary for the time because there is no law to mandate that businesses do this. Until its law nothing will change.
- I think that most people are just too callous and too mean to give a rat's ass about people like us.
- Most people strike me as having big areas of cognitive disconnect. There are adjectives that are often hurled in my direction that are actually more descriptive of the accuser, but they don't seem to realize it. For example, one that I get a lot is that I am arrogant. I'll put this as simply as I know how, I do not insist that

everyone needs to be exactly like me, but other people, especially people in groups, do insist that I have to be exactly like them. Which one of these is arrogant? To me the level of arrogance in most people is astonishing. They don't view themselves as arrogant, they view me as charity. Their attempts to force me to be like them are the equivalent of raising me up.

- From my perspective I don't want to be dragged down to their level. The gossip, the dishonesty, the temper tantrums, the back-stabbing, I don't want to be around that stuff and I don't want to be victimized by it. But it's even more profound than that, it is not just their behaviors that are problematic, I find them to be intellectually offensive. The actions of others who are supposed to be normal just seem to be beneath any level of human intelligence. I would not want to live if I had to live like that.
- Many NT's seem to behave in ways that to me seem beneath the level of human intelligence, bullying, gossiping, and dishonesty. There is a lot of darkness that goes along with social integration.
- I am often called robotic. People say I am like a robot because my emotions are informed by my thinking, because I don't know how to emote. For most people, it seems they emote first then think better of it later. I don't like the idea of replacing thinking with emotions. To me thinking should inform emotions.
- People call me robotic, but their behavior is strikingly robotic to me. No matter how bad people feel or how rotten their day is they say "I'm fine, how are you?" That does not even feel human to me.

- NT's often remind me of the Borg Collective on Star Trek. I don't want to be a 'sheeple.' Others can do all this stuff but they don't seem to be able to think independently.
- A couple of weeks ago, the special education teacher I was presenting with, was explaining why it was hard to get kids with autism to stand in line, saying it was their sensory issues. Then she turned to me and I said "The reason I don't like to stand in line is I am not a cow. I don't want to be herded."
- So the frustration for us is what you are trying to do. Take this for what it is, I am going to pull a total 'Aspie' card here, sometimes it is really hard for those of us on the spectrum to be interviewed and measured by someone who isn't one of us.
- We often try to talk about autism like it is a linear continuum. I think that is wrong. If you have ever seen a three dimensional object with x, y and z you should think of autism like that, only with a fourth dimension to it and that fourth dimension in physics is time. In this model, you can have two points in space that are not necessarily connected to each other. But if you fold space, time connects the two points to each other. So for us, our broken skills make sense when you think about it in that format. So if you are on that three dimensional model and most of your skill sets are way down here, but you have one or two of these little sets that are way up here, we might think of ourselves as not very functional. But if you fold those points together, like folding the space time continuum and you line them up, then they can become extremely functional, and finally you are a whole person.

- We often think about ourselves as not whole people because of all of these broken little things.
- You, as an educator, are probably looking at the autism spectrum within the lens of the neuro-typical world which expects us to be in the center of some imaginary axis. We are on a different axis altogether.
- Sometimes people tagged me because my life isn't characterized by many of the things that others are characterized by. But all of the classmates I grew up with have a pretty healthy cross-action of some if not all of the following: divorce lawyers, spousal maintenance, credit card debt, drug habits, convictions etc.; I have zero of those. Some people say you must be smart to have avoided all of that. But for me, it is just having the wisdom to know from a young age that I just wouldn't be able to juggle it all.
- I don't think that most (NT's) are lacking in intelligence, there is just this lack of discernment that I see in them. One-on-one, outside of their group, I find most NT's to be pretty intelligent.

Injury on the spectrum. This next topic fell within the realm of foundation for me, because it gave me much to consider about how autism, as a possibly neuro-developmental difference within humans, might be evolving or changing over time. Because I had not considered this in my literature review, I returned to the literature and affirmed that the most current perspectives on causality in autism see both epigenetics and environmental loading, coming together, to create the conditions of autism (Jeong, Son, Kim, & Yoo, 2015). In their review *The Evolution of Autism*, Jeong, Son, and Kim and Yoo (2015) support what those in this study had to say about the potentiality for

injury in the neuro-diverse group of genetic individuals with autism for recent generations.

Though I can find many examples of Asperger traits in my family tree, going back for many generations, the incidence of low-functioning autism is unprecedented for us prior to my children's generation. This leads me to consider the possibility that this generation of Asperger children might be injured "Aspies," with that injury localized to their corridors of interacting with the world.

- I don't believe that we need to be cured or even have our differences prevented, but whatever environmental things are injuring our children to these more severe levels, does need to be figured out and prevented, if at all possible.
- We need to understand, that for those of us who are very low-verbal or non-vocal, because these individuals seem damaged within their sensory and language processing systems, I think we must first teach them how to manage sensory inputs. I believe then communication will come.

Learning style differences. Next, and as the final topic included within this section, I chose to integrate a number of ideas about some essential core differences that seemed to exist across the 'normal' ASD spectrum for those in this study. In reviewing and understanding this data, I came to several conclusions that I believe provide further foundation to understanding the primary categories that emerged in the study.

The first of these is that for those with ASD, at least those in this study, it isn't always clear to them how different their thinking actually is. Second, as is true for NT's, it appears that the members of this study are quite a bit more diverse, in regards to innate learning style or verbal/visual propensity, than perhaps the evidence-based research

would suggest; with some being very visual and others much more verbal. As would be expected, those that reported being more verbal had performed better in school and their performance was more easily reflected within standardized testing. Next, I uncovered the idea that those with autism are either "math phobic or language phobic," which was introduced by several different participants. Finally, and in reading through all of the data relating to that perspective, I inferred the possibility that learning style might be even more pronounced, than it is for those who are NT, at least for the members of this study. The participants all agreed that being able to work within either one's innate verbal or visual strength area was aligned with vocational success, although other variables, such as social interaction, also played an important role. Last, more than one of the individuals in this study felt that one's cognitive difference could be likened to an optimal corridor for functioning; therefore, the preferred learning style would most likely to be the one that was the least affected by other 'autistic' differences or skill deficits.

Because more than one of the primary topics refers to the idea that those with ASD are either "verbal fact people" or "visual /sensory people," I felt this discussion belonged in the foundation section, although it could arguably also reside within several of the other primary categories. The primary ideas that supported these foundation thoughts follow:

- Until I was older, I didn't really know that I was different; well I knew I was different but I just didn't think it was a difference that made a difference.
- I guess I still don't really know how different my thinking processes are.
- We are visual thinkers.
- Some of us, like me, do not think very visually at all.

- There are those of us who just cannot do math.
- It seems that for those of us on the spectrum, we are either math phobic or language phobic.
- I was very dyslexic in addition to having autism. I couldn't read until I was 11 years old.
- We either can't spell or write, or we can't do math.
- Some of us remember everything that was said (verbal fact people) and then there are those like me that remember sights, smells, sounds, and melodies (this participant is blind).
- Some autistic people may be gifted in a technical sense and are lucky enough to establish careers in professions such as coding or engineering which is presumably tied to their strong visual learning style. I am very gifted in the humanities, even though I, and others like me, find it very difficult to adapt to the workplace, since these types of fields often involve a high level of social interaction.
- There appear to be remarkable differences between us in our visual skills versus our verbal skills.
- There are those of us that are verbal fact people and there are those that are visual and sensory information processors. That difference seems to be fairly entrenched within us, even when we are young.
- I am not so sure that there is that much of a core difference between us internally, although I think the main difference is in having a viable corridor for processing

and communicating; whichever one is stronger, the visual or the verbal will be utilized.

Primary Category One: Sensory Processing Difference

As the largest (by almost triple the amount of data) of all of the categories, the sensory category, first and foremost, highlighted that for all of the participants in this study, significant sensory differences were a major factor of their autism. Frequently likened to a sensory 'super highway,' individuals in this study all suggested that they believed their sensory systems were different than those of NT's both from the perspective of 'more sensory information to process' and from the standpoint of 'less ability to filter.' While some indicated that sensory issues had gotten better with age, others suggested that they were in flux and although different, at times, were never very far away. I found it interesting to note that participants in this study had some insightful ideas about their sensory processing differences and these suggested that individuals with ASD both process and reflect on more sensory information than NT's. Several of the participants aligned high intelligence with their high amounts of sensory information and one suggested that the unusual nature in which those with ASD process sensory information and make sensory connections might give the impression of high intelligence. Three of the men in the study used the analogy of serial vs. parallel bus ports on a computer to explain their sensory differences, one with considerable detail and explanation. With a common analogy and reference to suggest that "my sensory system is like a superhighway," most felt that their sensory differences were both a blessing and curse. General statements to support these conclusions follow:

- I always have had significant sensory issues. Some of them have gotten better and some of them have gotten worse over time.
- I suspect that we think in specifics and sensations. I've noticed that autistic people are likely to describe specific sensory experiences they've had rather than the turn of events that others might be focusing on.
- It seems to me that the higher one's intelligence is, the more sensory information they are faced with.
- If intelligence is the process of making connections between ideas and solving problems, then having unusual sensory experiences might make a person seem unusually intelligent or creative.
- I think our differences in sensory processing can be likened to the differences between serial and parallel bus ports on a computer.
- A serial bus is like a single-lane road. If you had eight cars that were traveling together, they would have to form a single queue to pass that stretch of road and regroup again, after passing it. I'm pretty sure NT's process in serial. But a parallel bus is like an eight-lane freeway. The same party of eight cars can travel its length eight abreast, if so inclined. I (and others like me) process in parallel.
- Using the model of a super-highway, during periods of hypo-sensation, a "lane" is effectively closed. Hyper-sensation would be analogous to an elevated speed limit in a given lane.
- Sensory differences are my super-power. While I have certainly struggled with them throughout my life, I can also say, at times, I really enjoy them.

Sound. In this subcategory to sensory processing difference, it appears that at least for this group, sound sensitivity and or sound hypo-responding were the most severe of the sensory issues and some aspect of these affected all of the participants. While the majority of the respondents report significant issues with pain that they associate with certain sounds, for those who are hypo-sensitive, it seemed that the very same sounds that were painful for some were the ones completely absent for others. An interesting observation made by one of the participants, and one that I tested with several others, was that for those who are 'strong verbal facts people,' i.e. those with a clear verbal learning style, their issues with sound tended to lean towards the hypo-sensation side of the hyper- to hypo- sensory pendulum swing. Three of the participants also specifically identified themselves as having perfect pitch and all of these three were seriously and negatively affected by sound. Comments to support sound as a primary sensory difference for those in this study are detailed in the following points:

- My worst area of sensitivity is for sounds. I literally have pain in my ears.
- Certain noises really hurt. I remember experiencing a fire alarm where the pain of the sound seemed to start at my head and radiate all through my body.
- I have heard others talk about hearing the Wi-Fi system, which has actually been documented, but in terms of some of these sense noises, I find them very distracting.
- I didn't realize that this was a problem, as I had always worked in quiet environments. But recently I have come to realize that my ability to deal with this is much poorer than other people.

- If I can make a comparison, someone talking near to me is the equivalent of a light being shone into the eyes of a NT. It can't be blocked out or ignored and the effort required to overcome the distraction is very stressful and tiring. When this happens my quality of work goes through the floor, which is deeply embarrassing.
- I enjoy getting away from the city to a place where I can hear everything from very far away, and nothing hurts my ears.
- Way back in primary school my class was tested for auditory differentiation (telling two slightly different tones apart) and I got a perfect score.
- I have absolute perfect pitch, which has been tested.
- Loud noises don't bother me at all. I don’t even hear some sounds.
- I’m quite hypo-sensitive to sounds in fact and it actually causes some issues with safety. I remember once the whole block was up in arms because my fire alarm was going off for several hours and the police finally came, but I didn’t notice it.
- My hypo-sensitivity to sound makes driving a bit dangerous because I might not hear an ambulance, a police car, or someone honking their horn at me.
- I know lots of ‘verbal facts’ people through autism and Asperger support groups. They seem to be the types who are great at trivia. They also seem, at least from what I can tell, to experience fewer sensory disturbances, especially for sounds.
- People who think in words seem to experience less sensory issues, please don't take this as fact - it's just an observation from my own experience.

Lights. I initially thought about this category in line with the previous one as sensitivity to a variety of visual assaults. But across my entire data set, I did not have a single person refer to any other visual sensory issue except for lights. So, the category

title remained under the heading of lights and includes first and foremost, the offense of fluorescent lights. Next was flickering, blinking, or very bright lights such as light-emitting diodes (LEDs). The discussion continues with one of the participants describing his ability to see the heat frequencies based on certain types of lights. Given their issues with lights and their ability to see light in a variety of spectrums not often reported by others, several of the participants had independently arrived at the conclusion that a different visual processing pathway or "module" might exist for some with ASD. One of the participants also spoke in detail about the disparity of seeing visual information from two different eyes (I queried several others who were very visual on this theme and none of the rest said this was true for them). In line with the idea that verbal learners might be more hypo-responsive, I queried respondents to see if there seemed to be less visual sensitivity for things like lights, for those who were less affected by sound. Their responses suggest that, at least for this group, sound and light sensitivity might go together. Specifics to support these conclusions follow:

- I am very sensitive to fluorescent lights (I can also hear them).
- Flickering, blinking, or LED lights are painful and I get headaches from them.
- Standing under bright florescent lights is not really within my skill set.
- Lighting made a big impact on me when I was young, especially florescent lights.
- The harshness of some lights was really, really painful. They gave me headaches. But that has sort of changed as I have grown up.
- My bat cave condo is kept very dark. I use little blue bulbs that give off just a minimum of light so I can see what I am doing. Then, if I really need to see stuff, I will turn on the brighter lights.

- I have a tremendous amount of awareness about color and light intensity. Sometimes colors are just too bright. I can see the color temperature of lights, the pulsing frequencies of LEDs, fluorescent lights, sodium, mercury, and even tungsten when they start to fluctuate. For me it's generally a good skill set because it is applicable to my career, but for other things it is highly offensive.
- I can't have an LED in my house because it becomes too painful for me.
- I don't notice sounds or blinking lights. In fact, lights don't bother me at all even though I know they are a problem for many people on the spectrum, I just don't notice them.
- I'm quite hyposensitive to things like fluorescent lights. People come into my office and ask, "Isn't that flickering light driving you crazy?" I just tell them "I didn't really notice it until now." Sometimes it's a problem though, but mostly because it is a problem for others (from the same person who was not aware her fire alarm was going off for several hours).
- I have noticed that for those of us who are very visual, we are also more sensitive to visual things like lights. I think there is a different neural pathway system there for those of us on the spectrum.
- As I have learned more about brain functionality, I have discovered that specific 'modules' exist for processing different aspects of visual information and others for other sensory input. I think for those of us with autism, we have a different visual module.
- I think at least for some of us, our brains use the disparity between each eye to great effect.

- For them (the verbal facts people) it seems they are also less sensitive to visual things like blinking or fluorescent lights.

Touch and texture. Within this category, only about half of the respondents chose to discuss differences with touch and texture, while in the previous two categories every one of the participants had something to say. It seemed that touch and texture were generally improved for the participants since their childhoods, although touch sensations were still notably disrupted for some. Those with touch disturbance reported that understanding disrupted touch sensations had helped them learn how to accept it. In so doing, two of them had learned to associate light touch with pleasant touch, at least in some cases. Distractions such as clothing tags were mentioned as being particularly offensive and for one of the very hypo-sensitive participants (based on responses to sound and light) texture in food was interestingly a very noticeable problem; this suggests that while some sensory systems can be hyper-sensitive, others might be hypo-sensitive within the same individual. The supporting data follow:

- I sometimes experience touch in a strange way.
- I don't always only feel touched in the spot where I was touched.
- Someone will touch lightly or unpredictably and some of that sensation will travel throughout that side of my body.
- Touch was really a problem when I was younger. The lighter the touch the more unpleasant it became. It was almost like nails on a chalkboard, except it was on my skin. But more firm, slower grips, like hugs, were generally ok.

- Now that I finally understand what's happening to me, the touch thing can be pleasant. A friend's light kiss on the cheek can feel like they caressed that entire side of my body with a large feather or a brush.
- I have to wear the right texture of clothes, natural soft fabrics, and nothing too tight.
- When I was a kid I could not stand that tag in my shirt, it was like somebody had a knife in me.
- If I don't like a food it is usually because of the texture.
- I am pretty limited by what I can eat as certain textures in food really bother me.

Tastes and smells. On the topic of taste and smell, heightened sensory awareness was praised for its ability to keep some of the participants from eating something that was spoiled and for providing added value to recognition of places and people. One of the participants describes her ability to smell or eat stronger tasting foods in relationship to her level of fatigue. During a discussion about smells, one of the participants voluntarily opened up the topic of sexuality for its relationships to under and over-sensitivity as things like smell relate for their effects on sexuality. Several of those in the study referred to the enjoyment they gained in eating due to their heightened senses of taste and smell. These data follow:

- I've been told that my sense of smell is amazing.
- I tend to notice lots of different smells.
- I often recognize people and places just by their scents.
- I am the first person to know the milk is going bad. Others will realize it a day or two later, but for me it is strong the moment it turns.

- My sniffer saves me from bad stuff going in my mouth.
- Once, when I was a kid, my mom tried to put the cheap brand of ketchup in to the good brand ketchup bottle. Before I even tasted it, I was sure it had gone bad. Then she started looking guilty so I put it together. I can be pretty darn sensitive when it comes to smells.
- There is an ebb and flow that I can't always predict. For example, there are days when I might be able to eat a piece of pizza with a little parmesan on it. Then there are other days when I have to leave the room because I can't take the parmesan smell in the air. It has a lot to do with the time of day and how taxed my mental state is. I'm generally higher functioning earlier in the day when it comes to smells.
- I think for many of us there is a hyper-sensitivity towards sexuality. The physical, the olfactory, all the smells, it's awkward to have this conversation but I think we need to have this conversation.
- I can pick up really subtle things in tastes that are really fun. I don't seem to get overloaded by that stuff.
- I love all the smells, even some of the stronger ones.

Combined sensations and synesthesia. Defined in the Merriam-Webster collegiate dictionary (2005) as a "concomitant sensation; especially a subjective sensation or image of a sense other than the one being stimulated," synesthesia was reported on several occasions, beneath the topic of Sensory Processing Difference, from multiple participants in this study. This area was especially interesting, because one of the participants in the study was blind, and for her, a great deal of 'visual imagery' seemed to

accompany her sensory sensations. But, by listening to the participants in this inquiry, it seems that synesthesia is not uncommon for others across the spectrum. For at least one of those who experienced synesthesia in this sample, the experience was particularly confusing when he was a child. The data supporting the evidence for combined sensations and synesthesia that were often more confusing in childhood for those in this study follow:

- Because I am blind, I make unusual sensory connections. For example, sometimes when I hear music, I see all of these colorful moving images in my mind.
- I often combine sensory sensations. For example, I have described certain smells using texture and can give coherent reasons why I chose those textures. To me, pepper is prickly because a pepper shaker doesn't give a constant smell. It gives bits of almost pain with less scent in between, like touching a cactus and feeling the sharp spines and the plant underneath.
- I have a kind of synesthesia where sometimes the sounds in music seem to form shapes and patterns in my visual system.
- I love my synesthesia; it lets me see things in my mind when I hear music.
- When I was little my synesthesia was very disorienting and confusing. I didn't think any other people had the same experience, so I assumed that something was wrong with my brain.

Coordination and safety. For the majority of participants in this study, in addition to their sensory processing differences, they brought up examples of how sensory processing difference caused them to be un-coordinated, especially as children.

This helped me to see that there is possibly a direct correlation between processing sensory information accurately and responding with accurate body movements. The points below on coordination detail specifics, their ties to socialization, and explain how sensory-related coordination issues can, when severe, even result in issues with safety and mobility.

- All told, I believe we are limited by how well we processes and respond to the data of the world outside of ourselves. If we can't process our sensory information we can't act on it appropriately.
- My sensory differences have really interfered with my coordination.
- My abilities in some areas were certainly offset by my not being able to ride a skateboard, run and dribble a ball, or dance.
- Anything that would take coordination to do, I didn't do very well.
- The physical coordination of the other kids was amazing. They could ice skate, do all this stuff I couldn't do. I couldn't even run with my hands in my pockets.
- From my perspective, I well understood that the physical coordination of others far exceeded my own.
- The only thing in school I didn't do well at was gym because I am not coordinated at all.
- I wasn't all that terrific on the playground because I am just not very coordinated.
- If the girls are all doing Double Dutch and you can't even jump a regular jump rope than you are just kind of out of it.

- I feel like when we get to the point where we are so sensory sensitive, touching, sounds, certain tastes, not being able to eat certain foods, then we are just not able to process and that can be real problem for a variety of reasons.
- One thing that happens to me if sensory issues are really chirping off, hot cold, smell, my clothes are too tight and I am eating, I will choke. My entire system just tightens up so if I am in those situations, certain foods are just dangerous to eat.
- If I'm crossing a street and loud sirens go off, I get disoriented and I probably am not traveling safely.
- Walking on ice is literally very dangerous for me.
- I have very slow reaction time.
- Once, when my sensory system was completely overwhelmed, my body literally just froze. I couldn't move my legs for almost ten minutes. I knew I needed to get out of there, but I really couldn't walk. I had to just sort of drag my legs to get to the car.

Primary Category Two: Focus

In the second category, with my clinical background, I came to this data set with a bit of a preconceived idea about an alignment with autism and attention-deficit disorder (most notably as ASD is currently considered to be closely tied to the disorder of Executive Functioning by many in the field). It didn't take long though, to interpret this data as something very different than 'attentional.' Most notable, was the highlight that those in this study reported being able to focus on something to a degree that is quite uncommon; but that focus was generally associated with focusing on one thing at a time.

This idea led into the concept of hyper-focusing and subsequently gave insight into some of the ways that those with ASD might be able to see systems or detect patterns that most NT's miss. This section concludes with what I found to be a unique insight between intense observation of the physical world and ties to the meta-physical. The data to support my conclusions for this section follow:

- I think for us there are notable differences in how we focus, but it is certainly not an inability to focus.
- Our attention can be hyper-focused to a degree that most NT's will never reach, this is autism 101.
- I have a marked ability to focus on one thing.
- I believe that most people with ASD have a superior ability to focus their concentration on a particular task, for long periods of time, to the exclusion of all else.
- We tend to be able to focus on and notice design and complexity embedded within what might seem to others as chaos. That alone can be fascinating. But when that design has metaphysical ramifications it becomes even more compelling.
- When I was a kid, my family knew that if they couldn't find me I would be staring at a tree somewhere in my neighborhood. I could spend hours looking at trees. I knew that the tree had been made, but not made by humans. That was fascinating, it still is. The entire ecosystem of a tree was interesting. Squirrels, birds, colors, forms, it's all so magnificent. Take a walk just after dusk when the tall trees are

silhouetted in the night sky. It's a reminder that there's something out there that is bigger than us.

Multi-tasking. In spite of 'marked ability to focus on one thing at the exclusion of all else,' universally, this group of participants all reported challenges with multi-tasking. The only participant who did not feel she had significant issues with multi-tasking went on to describe how her secretary prepares her in advance for almost all of her daily activities, including things like where she should sit, who will likely be sitting next to her, etc.. This person also reported that she was unable to clean her house and had to hire a housekeeper to manage things at home. For the others, many examples of multi-tasking difficulty were identified, along with examples. The final comments in this section pertain to world-views about multi-tasking and a theory that explains why multi-tasking might be so problematic for the majority of those on the spectrum. Comments supporting these ideas are listed below:

- I believe that others see "executive functioning," as a shortcoming for us Aspies, it isn't; I focus and I recall information just fine, I just can't multi-task.
- I don't multi task well, but I can focus on one thing better than most people.
- I think it has a lot to do with a marked ability to focus on one thing and marked inability to multi-task.
- Everything about me that you could say is a downside there is also a way to see it as an upside. I can't multi-task but I can single task better than anyone I know.
- The way we see it is determined by how the numbers break down. If 99 percent of the population were like me then we would not live in a multi-tasking world, we

would live in a one-tasking world and it would be the people who were bad at one-tasking who would have a syndrome.

- Ove the years I have developed the concepts of dynamic and static imagination. Essentially anything which requires someone to think 'What If ...' during a process requires dynamic imagination and is not suited to autistics. But, anything which can be pondered offline and built up gradually into a larger structure requires static imagination. Thus an autistic could produce impressive works of musical composition or imaginative drawings if left alone, but fail completely to perform in real-time or explain these to someone else. Perhaps what I am simply overelaborating is our very, very poor ability to multi-task!

Focus ties to sensory difference. While a bit unexpected, this subcategory evolved, and as it did, I was left with the feeling that I would be forced to tie all of the subcategories, one to another, and thus any possibility of a linear write-up, which at this point was already in progress, was impossible. But, to my relief, this subcategory, albeit seemingly non-linear to the write up of the other subcategories, seemed to resolve itself as I depicted the data within. These data clearly and concisely describe the relationship between focus and sensory processing difference. As such, the statements that gave support to the category follow:

- Others have the tendency to believe that we have a diminished capacity to allocate our attentional resources and for this reason alone, we can't process sensory information. But anyone with ANY autism experience can refute that.
- I do well to focus on one thing. If the one thing that is vying for my attention is a sensory thing, say an uncomfortable bump in my sock, I have to get rid of it.

- If I can't stand to have socks and shoes on I have to take them off or I am not going to be able to concentrate.

Interests to facilitate focus. As I was gathering the data, I heard time and again how interest allowed for focus. This seemed like a 'no brainer' and I must admit, it wasn't until I heard the same thing 10, 15 times over that I began to suspect that there might be something different going on between interests and focus for those in my study. As a reasonably good student and scholar myself, I would say that I have a much easier time focusing on something when I find it interesting. But, because I kept hearing this, I had it on my radar. Then, during one of my ASD expert professional interviews, as the participant was describing an alignment with focus and interest that had been a topic in his professional research, the possibility finally dawned on me that perhaps those with ASD, because of their focused and often narrow interests, can't actually focus well at all on those things that are not within their narrow 'band of interest.' I posed this question to several of the participants and one even confirmed this by sending me a study that he had seen on focus in autism. The specific why, came later though, as I was sorting the data. It seems that given all the energy that is required to compensate for multiple differences, in spite of NT expectations of normalcy, those in this study and possibly others with ASD found it incredibly exhausting to focus on areas that were undeveloped within their 'band of interests.' The primary statements that I felt most closely aligned with this particular "aha" moment follow:

- I can concentrate for long periods of time while researching a topic which I find very interesting.
- I feel intelligent in the areas of general knowledge that I am interested in.

- I've always considered myself an "information junkie" having an insatiable desire to learn about things which really interest me.
- Others seem to be able to do it even if it does not particularly interest them, I can't.
- I need the energy that comes from being in the zone, doing something that I enjoy and find interesting to be able to compensate and focus on it.

Using a gas tank analogy, I might only have one gallon a day for things that don't interest me, but it seems that I have a full tank for things that do interest me.

Primary Category Three: Memory

Similar to the aforementioned category, although discovered much earlier in my analysis, the idea that those in the study had somewhat prodigious memory evolved. This began with all of those participating emphasizing, as a cognitive strength, their long-term memory (although most considered their short-term memory to be not nearly as good). This was combined for me with a story I once heard told by autism expert Temple Grandin. According to Grandin, when she remembered a church steeple, she remembered, usually in very specific detail, all of the individual church steeples she had seen in her life. As I thought about that, even though I have seen countless church steeples, I have this vague image, off in the distance, of one single church steeple set against a cloudless blue sky. That is essentially my only complete visual memory of the topic "church steeple." This forced me to ask the question, "Why do those with ASD seem to have countless, independent and fully developed sensory experiences of a multitude of different church steeples, when I only have one?" From there, I was able to piece together data on this topic to suggest that at least for those in this study, a different

memory system than my own (and for most NT people I know) might be in effect. According to the data, that system is highly intensified, can be very narrow in topic, but is extremely complete. Statements in this section also include personal theories about how memory is reinforced by sensory information and by interests for those with ASD. The concluding statements in this list of data seem to explain how senses, relationships, and interests strengthen an already sophisticated, long-term memory system. The supporting data for these ideas follow:

- I get that I am a sponge.
- I have really, really good memory.
- When I was a kid I had a memory that just wouldn't quit.
- I seemingly remembered absolutely everything.
- I have an especially strong, long-term memory.
- At this point in my life, my longer term memory is better than the short term memory, but I think my memory is quite exceptional.
- Short-term memory is more difficult.
- It seems to me that memory and sensory processing are tied together because the stronger a sensation is the more memorable.
- The way I can see memories, feel them, even sometimes smell and taste them, allows me to immerse myself in them, relive them, and remember them forever.
- I pretty-much remember anything that I find interesting.
- People like me remember certain kinds of verbal facts, but we seem to access and remember sensory data more easily.

- Ask me if I remembered to lock my door, and I won't mentally talk to myself. Instead I'll think back to when I left my room and play back the sensory log. Do I recall the feeling of my hand reaching into my bag, pulling out the key and turning it in the lock? Language memory is very useful but entirely unnecessary for this task.
- People who think like me seem to remember a more complete sensory experience.
- When I was 11 years old, my mother and I went to Switzerland to visit friends of the family. While there, we travelled by train down to Italy to visit my cousin who was living there at the time. At the end of the visit, he took us to the station in Milan, but somehow we got on the wrong train. Instead of heading straight toward the Alps as we should have, we were going back to Switzerland, we were travelling parallel. I tried pointing this out to my mother, but she wasn't about to take advice from me. Eventually she figured out we were going in the wrong direction, and we got off the train in a town called Chives. I remember it was cold and rainy and for some reason, I never forgot the name of that town. I remember everything about it just like it was yesterday. We were there only briefly waiting for a train back to Milan, I wasn't keeping a diary, and I don't think I made any conscious effort to commit it to memory; but there it is, and the fact that I can remember something like that with that much detail totally astounds people.
- As the aforementioned analogy of serial versus parallel bus ports applied to sensory processing it also applies to memory in the following way: A deliberate listener/observer watching for a specific "car" will cease watching once they have

> seen the car they are looking for. On a single lane road, that will be a single car (referring to a serial port and the way he sees NT's processing); all subsequent cars will be disregarded. But on an eight-lane road (referring to a parallel bus port, the previous discussion of sensory processing difference, and an eight-lane highway system of sensory processing difference for those with ASD), the sought-after car can be a member of a group of cars. In my case, and for those like me, the car I am looking for and the other cars in the same group will all end up in short-term memory. But if at a later time (while watching for the same car), any of the other cars re-appear in the group with the car I am looking for, their memory will be re-enforced (as being connected to the first car). If there is no repeat of cars, their occurrence will fade from memory, but the connections between repeating cars will be reinforced and remembered. Apart from originally-sought information, "which car" the information that "sticks" for me would be that which is novel, interesting, odd or disturbing.

Complete for specifics but not the general. With almost a sense of elation about finding what I was still referring to as a prodigious memory system, I read the data further, and as I did, I discovered that what these individuals were describing as a very sophisticated and complete memory system for the specific, was riddled with holes for the general. In this section, I highlight how thinking, remembering specifics, and even remembering something from an altered point of view is possibly the result of a very specific and detailed system of remembering that does not generalize across ideas. The data and main points follow:

- But this is a general issue for us; we are often not able to remember something at the same time as we are thinking about it.
- Even though I have an excellent memory, I find that my memory has very some unusual holes.
- I have exceptional memory but it has these gaping holes in in it.
- When I remember my childhood experiences, I often remember them from a very specific vantage point and sometimes that memory is very different than the memory of someone else who was there with me.
- I often remember a very narrow point of view, even though I remember it in complete detail.
- Sometimes what I remember, as my sole memory for a situation, is not at all relevant for others or even in line with what they remembered.
- In many instances my memories for a particular situation, even though they are incredibly detailed, are not very useful.

Visual, spatial, and verbal differences. For this category, the idea that memory, or perhaps its reinforcement, while different for those with ASD, might also include memory differences that align with the foundational category of verbal versus visual learning seems plausible. In other words, those with verbal learning styles have good verbal memory, while those with visual learning styles struggle with verbal memory. Less clear though is how verbal versus visual memory breaks down for those in this study who are very visual-spatial in their learning style. The topic of spatial memory was introduced by only two of the participants. Overall though, at least for the members of this study, strong sensory memory appears to be linked to nearly perfect memory

(albeit narrowly focused and sometimes not focused on the things others are attending to) for either words/sounds, or visual and spatial information. The data follow:

- People who think like me seem to remember a more complete sensory experience.
- I think we all have strong visual memory, but we don't all have the same ability to remember verbal information.
- I'm terrible at trivia. My visual memory is better than my verbal memory by quite a bit.
- My memory is very visual. I remember things better if I see them, rather than if I only hear them.
- I have a hard time remembering what I hear, especially in the short-term.
- I just remember things better, if I see them.
- I usually think in three-dimensional images, except if I am remembering what I read in a book or on a piece of paper, then I see the page. I can easily read a page from a book in my mind as if I am reading the page (this from the individual who didn't read until he was almost 11).
- Many years ago, when I was living in Hawaii, I was playing a Trivial Pursuit-type game with friends called "Trivia-Aloha." The question was "What is the state bird of Hawaii?" My mind went to the "H" volume of the set of World Book Encyclopedia that we had as kids. In my mind, I flipped the pages to "Hawaii." I searched the top of one page, where they showed the state tree, state flower, and found the state bird. I saw the page in my memory then I answered the question.

- I also have good spatial memory. I once knew that a certain cabinet-level official in one country where I served was out of favor, because he did not stand, where he normally did at an official meeting.
- I literally have photographic visual memory. I can see things in pictures so well that I can see Shakespeare in front of me now and I can actually read the words.
- I have an almost photographic memory for maps and can navigate anywhere having seen a map of the terrain of a particular area. I can just spatially orient myself to the terrain and follow the map.
- Oddly enough, I sometimes don't think my visual memory is that great, or perhaps it is too great, because I miss details which are right in front of my nose because they are slightly different from what I was expecting. I have seen children make the same sort of mistake but never other adults.
- In terms of languages, I did OK, as I could memorize a huge amount of vocabulary but grammar was much more difficult. There were so many exceptions to grammatical rules that it seemed easier to map French, German or Latin onto English, which I spoke intuitively.
- When I am struggling to read something in English, I will often get a copy and read it in French. Even though English is my native language, I can sometimes read better in a foreign language (a similar comment about opting to read in French was made by two other participants).
- When I took a test it wasn't necessarily that I understood the subject matter, I might have, the advantage I had was I could remember everything the teacher said. All I had to do was write it down.

- Because I had this tremendous verbal memory I got tagged as being particularly intelligent.
- In addition to my strong visual memory, I could also remember everything the teacher said. It is why I did so well in her class. Everything she said was on the test.
- I can recall verbal facts easily; I'm especially good with trivia. My visual memory isn't as strong.
- With tremendous visual and verbal memory and the ability to access it, when I was young, it just came forward so quickly and that passed for intelligence.
- The reason I won the spelling bee was that the spelling bee was limited to a few thousand words and I just memorized every single one of them.
- I don't think I have a very good visual memory at all. Sounds and words on the other hand are written in stone in my memory.
- My strong memory for sound is useful for pop music trivia but not much else. If it is possible to have a near photographic memory for sounds, that would be it.
- When replaying a sound in my head, I often come across an aspect of it that I was not consciously aware of when I actually listened to it, like a drum beat or horn flare.

Compartmentalization and object permanence. This category emerged within the data, but as I attempted to detail it further, I determined that it continues to lacks clarity, even though I spoke with several of the participants about it in detail. The main points within it suggest that because the memory system is so specific, compartmentalized, and grounded in the singular (versus the general), that memories of

an entire life or person can become ‘lost.’ More than one of the participants described an experience similar to the discussion about the lost wife. Clearly this isn’t well articulated, as I myself am not too clear on the topic, but could be of special relevance to younger children with a highly developed sensory/visual memory system. The statements within this topic follow:

- I think because I have such strong memory, I can compartmentalize my memories very easily.
- I think I sort of pack up some areas of memory then lose them.
- Lost memories cause me to struggle with what I believe most would call “object permanence.”
- I think problems with object permanence were especially relevant for some of us when we are young.
- Sometimes when I travel and I have been away for a few weeks, I can’t quite remember what my wife’s face looks like, and because of that, I have a hard time remembering for certain whether she is real or not. I have found that it helps to see a picture of her face to make her feel real to me and to help bring me back to my memories of home.
- When I am away from home for some time, I can’t really remember if I have another life, I just am in the life I am in. But when I get home, then that set of memories opens up and I can’t easily remember the broad aspects of my trip, although I can remember in great detail, some of the specifics.

Passage of time. Although deeply tied to the previous category, I felt that these specifics might simultaneously add dimension to the previous, but might also exist

independently. For that reason, I chose to list them separately, as a subcategory beneath memory, but within a discussion of how the sense of altered passage-of-time for those with ASD might be tied to differences in how memories are reinforced and stored for some of those on the spectrum. The supporting statements follow:

- I believe that our deficits in short-term memory lead us to an inability to process certain types of data in real time, unspoken social cues as an example. The outworking of this would be a seeking of predictability so that you are relying on long-term memory to interpret the world, rather than relying on sense memory/short-term memory for your speed of processing.
- When I was a kid I could stare at something for hours and not know it had been hours.
- I do have a strong association with other times in memory; I can remember them like they just happened.
- If I hear a song I might have a very strong image of the store I went to in 1979 where I first heard that song and that brings me back to that time and place such that I can re-live that experience completely.
- Or you know, when I am reading a story; the time around me almost feels like it stops. Whatever it is I am reading it's like I have to stop and pull myself into the real world, it's almost like jumping from place to place, or time to time.
- In my memory, it is not just an emotional attachment to a particular time, it's actually physical. It can be really enjoyable or exciting, but it has its downsides.
- I seem to be pretty well routed in my reality now, but I didn't always have a good sense of passage of time.

- I am sometimes made aware of how time escapes me. I once played guitar at a pizzeria and I was running a video for promotional purposes. When I watched back through the video, I realized that I had no idea that his person had said good night three times before I even answered. I just lost that time within everything that was going on around me.
- I think it just takes such a high level of concentration for me to do certain things that time and memory kind of pass without my awareness.

Primary Category Four: Cognitive Difference

As the second largest of all of the categories, while the topic of cognitive difference held no shortage of data for me, its logical placement within a linear narrative was somewhat more challenging. Going back and forth between: (a) the idea that sensory processing differences contribute to an already different style of cognition that include such things as memory and focus or (b) the notion that because sensory processing was significantly different for those with ASD, a different form of memory, focus, and ultimately cognition evolved, I finally decided that the problem could not be resolved within a linear dialogue, because this topic, along with the three that came before it were continuously cyclical and recursive.

So really then, I was just left with the decision about which to place first in the narrative. Using a simplification sequence of cognitive philosophy, namely, "I sense, therefore I think" (Nershberg, 2010) versus the more famous French philosophy of "I think therefore I am" (Descartes & Cottingham, 1985), I arrived at, as my most logical sequence, one of sense, focus, remember, develop cognitive neural pathways, repeat. However, in so doing, I think it still important that the reader attempt to see this sequence

as both cyclical and non-linear for a fuller understanding about my own views on cognition and cognitive difference for those with ASD. A recursive view is also required to understand more fully how I came see and interpret these data.

A single, preliminary statement about innate cognitive difference for those on the spectrum is highlighted in the following opening statement.

- I can say based on my own experience with autism and having taught many other people on the spectrum that our ability to acquire certain information, retain it, then see or sense unique patterns is pretty unusual and sometimes even pretty bizarre. I mean that in a very positive way.

Visual differences. With known strengths in pattern recognition skills that have been heavily reported in the evidence-based literature, as I began my analysis of the data obtained from the 14 initial participants, while a clear pattern of cognitive difference seemed to be emerging, I actually anticipated some other unusual cognitive differences that could be categorized as either visual or verbal. Furthermore, given what I had already uncovered about the vast differences these participants had in sensory processing and memory, I believed that I would find a similarly wide range of cognitive difference.

This was surprisingly not true. For all of the participants in this inquiry, in spite of their hyper-or hypo-responding, their vast differences in interests and vocations, and the wide disparity reported between their visual and verbal memory strengths, all of those in this study referred to their ability to see or sense patterns and rhythms as a universal strength (remember that one of the participants is also blind).

Other cognitive strengths that appeared as universal included the ability to ‘see’ the problem, attention to detail, and sensory or visual thinking. For those individuals

who previously identified as very visual, another common theme was the ability to glance at something, often out of the corner of the eye, then see it in 'freeze-frame' (as if a single event had been photographed using a rapid lens, but within a series of independent, still images). For two of those in this group, the 'freezing' of a visual image sequence sometimes came with the ability to stop, slow, or even speed up the singular images of a particular event and re-play it later on. Less consistent were the visual-spatial abilities of those in the study, with the members of the distinction 'strong verbal facts people' often reporting fairly significant challenge with visual-spatial problem solving; those who were very visual in their learning style reported nearly perfect three-dimensional, spatial problem solving abilities. This section concludes with a few statements about how individuals in the study viewed these unique abilities amidst similarly remarkable deficits. Statements to support general cognitive differences follow:

- Based on what I have talked about with other people on the spectrum, we are incredibly skilled in specific things, but we also have extremely specific deficiencies.
- I think NT's have access to the bank of knowledge that is used by those of us who are on the spectrum. But I think something happened to us that caused a fracturing and gave us this unique ability to do this stuff, sometimes at the expense of other things.
- I have a good ability analyze disparate information and come to a conclusion that is correct.

Specific to the cognitive tasks of visual and the visual-spatial strength, the following statements support visual aspects to cognitive difference:

- I am gifted in my non-verbal capacity.
- My ability to see things that other people can't is pretty unusual. I see super specific details.
- My autism increases my ability to acquire information and it increases my ability to take disparate pieces and create an abstract form that other people can't conceive or visualize.
- I am especially strong at problem solving and visual pattern recognition.
- Visual patterns are definitely a strength area for me. I also have above average attention to visual detail. Seeing patterns, linear thinking, spotting ambiguity, these are my strengths.
- For a job, I was once given a programming task to process some files. The input files were for some kind of genomic sequencing project. I don't know who or what generated them, but I was able to look at what appeared to be random symbols and see a pattern, and that pattern showed me what my program should do.
- My friend is a theorist in high energy particle physicist and I remember when he would come back from Harvard and we would have these conversations; he would say I know you are just an artist, but I have better conversations with you than I do with the physicists, because they often can't see these things.
- I can easily see time and space, light, frequencies, and wave particles so physics makes perfect sense, because I can visualize it. It’s what I naturally see.
- Another wrinkle in figuring us out is one that happened not too long ago. I had a glass of water on the counter and I accidentally knocked the glass off with my

arm. Here is what I experienced. I knew I felt my arm on the glass, I knew the glass was gone. The next thing I knew, I had a photographic, freeze-frame set of pictures of the glass falling. It was like still photography. It wasn't like a video. I could see the glass midair with water coming out sideways, at all of these different stages until it hit the floor.

- One of my skills is I can look at a glance, retain what I see, and I can freeze everything in still imaged then re-play it all, in a set of single images in front of me.
- I still have each of these individual "freeze-frame" like photographs in my memory of that event. I can replay them at any speed I want to.
- The other thing that happens is, I have had moments where I have seen a person enter the room and while they are in motion, I can go through a series of actions in my mind and see their movements, frame by frame, before they actually happen.
- Even though I am very visual, I sometimes have to watch movies several times to figure out the plot. I think I just see much more than what the producer of the film intends for me to see. It's why I don't see movies in the theatre.
- Well, I could give you an example of visual thinking correctly applied in cognition. When I was in the army, they would run a betting pool to see how fast I could get from one particular point to another point. They would show me a topographical map, then blind fold me and take me out, it could be any distance, and they would take me out and drop me off. With no map and no compass, I could take that landscape in front of me and lift it up and turn it, then take the map

I had seen and articulate its height and spin it in all the directions. From just that, I could figure out where my orientation in space was. In many cases I often don't need a compass, because I can just figure out the direction I need to go.

- Women on the spectrum that I know seem to have a high prevalence of problems navigating in cars or getting to locations. I have wondered if there is some chromosomal function to that particular visual-spatial task.
- I hear of people reported needing to plan-out trips well in advance and rehearse their travel.
- Many of us don't like GPS because it is so confusing and stressful.
- I have always been told that I am a very good abstract problem solver. This feels accurate.

Ties to sensory processing. In this section the participants clearly articulate the alignment between sensory differences and the 'products' of cognition. Several suggested that their sensory differences were attributed to higher intelligence, in spite of slowed responding or processing speed. Challenges with the specific versus the general (i.e. too focused on sensory details and thinking too much about them to see what is most important) were also associated. Supporting statements in this area follow:

- So I think our sensory differences don't necessarily determine our intelligence, but I definitely think they are very much a part of the expression of our cognitive abilities.
- I define intelligence as the ability to process information and reason quickly and accurately. I think sometimes our sensory problems can interfere with or hinder that speed.

- I have a theory that I developed over the years from my own experiences of going from not being able to express myself, either through communication or physically. I think that because I was trying to process so much information (both sensory thing and ideas in my head) and not understanding how to do that, I struggled with choosing what to keep and what to let go, and that made deciding what is important hard. Once I understood things better, it really made a big difference.
- I've seen people over the years come into pop cultural, with references in movies and television shows to autism, and I think there is a correlation between just how intelligent a person is and what amount of information they can observe and think about. But what is learned is dictated by how you choose or don't choose to process it.
- I feel like for us, the higher your IQ gets, you see this in savants or those with genius levels of intelligence, it's almost like the more you are able to process the less you are able to put out from that processing. It is like the higher the IQ gets the more assistance you need to translate what you are taking in to what you can put out.
- For people like you, it all comes together. But for someone with autism we see everything that goes on around us and we can't sort it. It's like if you take in more than you have the energy to process, then even a simple touch on the hand could feel like a million different things, pleasure, pain, or even a stabbing of pins and needles.

- I personally think that people with autism have higher intelligence and that causes them to take in more information, even though they don't know how to process it all.
- When an individual is unable to filter out extraneous sensory input, it is bound to have a rather permanent effect on how their cognitive abilities develop.
- We are very observant of the world around us, but we don't always understand what we are looking at or what we are sensing. That doesn't mean we are not intelligent.

Challenges with communication. As much as recognizing patterns emerged as a universal strength for those in this study, an inability to communicate without effort was also a universal challenge. Again, and irrespective of learning style, even for those who fluently read and spoke in several languages, all participants reported difficulties with getting their thoughts out orally. Statements that are in line with this theme follow:

- The ability to see a problem, but not express it convincingly, is deeply frustrating.
- I am a visual thinker. But when I see things, I often don't know words for the things I can see. I have an extremely large vocabulary, but I can't formulate the right language structure to apply it to the images, patterns, and sequences that I can see.
- My brain moves faster than my mouth, so I am constantly stumbling over my words and I am pretty clear about what I want to say, but there is so much I am trying to filter through this tiny little funnel that is my mouth.

- I definitely have a great deal of auditory strength, but what's difficult is sort of this speaking, in the sense of fluency. I mean the thought is already there, it's just that the fluency, actually getting it out of my mouth, is the problem.
- I think for people who are on the spectrum, we who do have a higher IQ, but maybe we are not able to convey it as well?
- Even with me, people make some assumptions because of my mannerisms in communicating. I think the first assumption, until people get to know me or know of me, is that maybe I am not catching on or maybe I am not as smart.
- I think it varies from culture to culture, but I think in the U.S., the North American context for sure, the ability to speak clearly, to speak at length without pause, is supposedly a sign of someone who is very bright. So, when you have problems getting the words out, the assumption is that it is because of a lack of mental ability and not some other reason.
- You know the positon I always take as an advocate is that there is such enormous potential within each one of us and yet how do you define what intelligence is? Is it what you are taking in, how your brain works, or is it how you communicate or articulate that knowledge to the rest of the world?

Seeing the big picture. Within the specifics of strength and weakness the theme of seeing the big picture emerged as a common strength area. As one might expect, this whole-to-part cognitive attribute was noticeably contrasted against the backdrop of not always being able to plan or take the small steps. Statements for this theme follow:

- I am great at sort of this big picture stuff, but I need my staff to write memos for me for the day-to-day things. They say things like you need to be at this place at

that time, this person will speak before you, this person will speak after you, these people will be sitting next to you, and you can do this or this at this time. It's all spelled out for me otherwise I feel kind of lost.

- I think most people can see the little steps but have a harder time forming the big picture. I can form the big picture easily, but can't form the steps to get there.
- Being able to see the 'big picture' is hard in a way, because I get overwhelmed by the details I will need to follow to get me there.

Learning – from the specific to the general. With what initially seemed contradictory to the previous category, this topic emerged, and as I thought about it more, it finally made perfect sense. What I think the individuals in the study are saying is this: Because we so easily form the big picture and seeing the steps to get there is a challenge, to learn something that is entirely new, we must piece together enough specific details to form the big picture. Until we do that, we are a little lost and can't really think about or fully understand the problem. Statements to support the need for step-by-step learning, from the specific to the general, follow:

- I often learn by going from the specific to the general. This is sometimes a weakness. When I was little, I remember asking my father how to tell if an animal was a dog. Dogs come in all different sizes and shapes, they can have very different fur from one another and they smell different. His answer was they just have this "doggy look." I finally constructed the general concept of "doggy look" over years and years of specific encounters with different kinds of dogs.

- I have to learn a new programming language by reading lots and lots of specific examples of how the language is used; eventually I can construct something original, a big picture, out of the parts I've learned.

Assumptions about intelligence. Because I specifically asked for thoughts about intelligence in ASD, I was given a wealth of information about how those with ASD view the topic of intelligence in cognition, as it pertains to them. The general consensus for this data indicated that in spite of advanced, cognitive strength abilities in some areas, others areas of weakness felt disabling enough for most in this study to question their own intelligence as well as the construct of intelligence for its usefulness to them. Their views follow:

- I've been told I'm incredibly smart. Some days that seems accurate; other days I'm barely functional and I wonder if Mensa accidentally mixed up my scores with those of someone else.
- My IQ test was pretty much inconclusive with too many highs and lows to derive a meaningful IQ score, although I've been told I'm highly intelligent.
- I don't necessarily consider myself that intelligent, but the end result ended up being very surprising. I ranked in the upper two percent of genius. The score didn't feel true to who I am, or to my academic experience, or to who I perceived myself to be.
- I suppose I gave the impression of being intelligent, but I've always felt anxious about learning about which I have little interest.
- I disagree with some knowledgeable people who say I am more intelligent.

- I've always done well playing "Trivial Pursuit" and "Jeopardy." I'm very interested in the current election campaign. So I would say I feel most intelligent in the areas of general knowledge.
- I've actually been told throughout my life that I'm intelligent, gifted even, by teachers, college professors and work supervisors, my best friend and my current therapists. I'm not really sure that is true or that their definitions of intelligence even really apply to me.
- My mother was told by one of my high school teachers that I had a very high IQ, although I don't recall if this opinion was reached as a result of an actual IQ test or standardized testing. I did well on tests, but then other things were just so challenging that I am not sure the tests predicted what they were supposed to.
- With my tremendous recall and the ability to access information, especially when I was young, it all just came forward so quickly and that passed for intelligence, but I am not sure that was intelligence.
- I never took an IQ test, but I don't think I am nearly as smart as people think I am.
- I was classified with Asperger's so I really can't discuss the entire spectrum. But I think at least for people with Asperger's there seems to be a tendency to sort of have an IQ that is higher on the scale than average. But I'm not sure that can really be compared to those who are NT.
- People with Asperger's Syndrome are often portrayed or considered to be more intelligent than normal because they can demonstrate high levels of competence within narrow skillsets. This can suggest that the gaps in their competence are deliberate. They aren't.

- The popular understanding of different types of intelligence (IQ, EQ etc.) helps in some respects, but with a big caveat. I think what we know can be very specific to only one or two areas. But perhaps having a high IQ can help us to compensate for some of that rigidity?
- I am often asked “How does someone who is so intelligent do such stupid things?”
- I think many of us on the spectrum are just too intelligent almost for our own good.
- ‘Intelligent' is also sometimes used to mean other things such as 'socially compliant,' which I am not.
- I think that there needs to be a distinction between intelligence and wisdom or discernment. Discernment is often the bi-product of applied intelligence to the task of independent thinking. I think we often have very sophisticated levels of discernment.
- I think for us, cognition and intelligence are independent of each other. I believe our brains have (at least) two major corridors for input/output services, A & B. Most NT’s lean on A primarily, but if one’s B corridor functions better than their A, that is the one we will lean on. Accordingly, whatever intelligence one has on board will prefer that I/O corridor. We are often forced to function within an alternative corridor.
- I feel that the type and level of intelligence one has and how it's applied can vary very widely throughout the autism spectrum.

- There are just so many different types of intelligence, whether emotional, social, intellectual, memory, planning, or problem solving. But every autistic person is different. Therefore, it's a bit difficult to generalize about intelligence in ASD.
- Some non-verbal people are gifted with a genius level ability in areas such as mathematics or music, but then lack the ability to perform the mundane tasks associated with independent living.
- I don't believe that NT's are necessarily more intelligent than the mute musician or mathematician who needs help with self-care, or with the well-educated Aspies stuck in menial jobs. But they might feel like they are because they seem to be able to do more things.
- I've limited my answer to how different types of intelligence among people with ASD will or will not help them thrive in the workplace and therefore, enable them to live independently. In that narrow definition, I am afraid we are not very intelligent.
- I have met so many incredibly brilliant people who have autism when I say brilliant I means some very specific things like they are dead on insightful about some things, but then can also be totally clueless about others.
- I believe that higher functioning people with ASD are more gifted intellectually than the average neuro-typical. However, the ability of the ASD person to adapt to a neuro-typical world will very often determine how well he or she can put those gifts to use.
- One's ability to adapt should be yet another measure of intelligence.

- You can have tremendous skills, all sorts of fragmented abilities but if you can't piece those fragments together does that limit your intelligence?
- Even though I have my doctorate in education, the highest IQ score I ever got in formal testing was 80. I doubt my IQ is actually that low.
- My parents were told that I should be institutionalized because my IQ was so low. But now I travel and lecture all over the world so it must not have been that low after all.

Cognition in low-functioning kids. Within their discussions on intelligence, most of the participants offered unsolicited thoughts about what might be going on within the cognitive abilities of those individuals who are very low functioning and/or non-verbal. By and large, almost everyone in this study attributed the more severe states of functioning to the lack of ability to understand the various aspects of their ASD and to their inability to articulate it. The idea that low-functioning might more aptly be described as too visual to be vocal was suggested. Comments to support the views of those in this study on the topic of low-functioning autism follow:

- If a kid doesn't have a vehicle to communicate, where would he acquire information or how would he articulate his intelligence? How would you know his intelligence?
- Every kid with autism I have ever run into seems to be plenty intelligent to me and in my work, that is a lot of kids! They just can't figure out their world.
- I have been around some kids that are very low functioning or non-verbal. But I think even for them, it is just more a question of accessing it or putting them in an environment where they are able to express it.

- I have two children who are more severely autistic and essentially non-verbal. In their cases, they are very intelligent, but it seems like they don't have a reliable input/output corridor to draw upon.
- I don't know how this works in practice, but in theory, I believe that even kids that are very severely autistic could be taught to understand what is going on around them. Once I was able to learn to process the world around me, I went from being lower to high functioning.
- So I don't feel like autism is necessarily lower intelligence, but instead, it is just a lot more sensory issues. I feel like you should approach autism from the standpoint that all these kids are intelligent, but some of them just can't figure out their sensory systems.
- I think the idea of classifying kids as low-functioning or non-verbal should be re-though entirely. Too many of these kids have proven themselves to be very verbal, once taught a method of communication that doesn't require their vocal chords.

Primary Category Five: Social Difference

The fourth category had an immediate and obvious place in the data from the outset, given clear indicators for social difference in the literature. But while thousands of studies have attempted to explain social skills challenges for those with ASD, what seems to be missing is the notion of NT bias and perceptions for the topic of socialization for those with ASD. As I reviewed the data for the individuals in this study, what emerged was the indication that social interaction is both a primary category of difference and a category of culmination for those in this study.

With alignment to all of the previous categories, I chose to open this category from the perspectives of several of the participants who attempted to explain their views about their own social processing differences. These different perspectives follow:

- My current view is to compare autism to sickle cell anemia in evolutionary terms. A low level of it is protective, even beneficial, to the group as a whole. Everyone benefits when an autistic's 'genius' discovers a new law of physics or invents something useful. However, too much and it becomes detrimental to the individual. However, the group is not badly affected by these individuals as they do not socialize much and they tend not to breed. Tough for the individual though!
- I believe that we socially understand too much, but recognize that most people are just not very authentic. This results in us placing less value on social things.
- I can only offer insight on my experience. It seems that the only data that might completely elude me is the social stuff of group dynamics. Sometimes that data just doesn't make sense TO ME, and other times I am convinced that it just doesn't make sense PERIOD! Either way, I tend to be in the minority. I'm either the only one who doesn't know what's going on or I'm the only one who does. Either way, it's problematic for me and viscerally frustrating for others.
- I find it useful to distinguish between physical reality and social reality when approaching a new situation. If it is purely physical reality, then I would have no problem dealing with the slower moving and repetition-tolerant issues which are likely to arise. However, social situations are fast moving and very not repetition-tolerant.

- As I have learned more about brain functionality, I learned that specific 'modules' exist for processing different aspects of visual information and others for other sensory input. So, it occurred to me that given how important social groups are for our success as a species, a social processing module may well have evolved. Like a math co-processing chip on a CPU. If this module did not function correctly, then it could explain why social functioning is so badly affected, while other apparently related functions, such as general IQ, might not be. Thus the problem lies in a specific part of the general processing engine rather than in a general aspect of it.
- In the past I have tried to explain my social deficits within the context of the brain as a general information processing engine. My explanation below sort of makes sense if you assume that there is something about social signal processing which is particularly labor intensive. I used to believe that this characteristic was the sheer speed at which such signals appear and disappear. You barely have time to notice that an eyebrow has been lifted or a tone of voice has changed before it has gone and been replaced with other signals. You certainly don't have time to ponder what the signal might mean. Now, I realize it is even more complicated than I first thought, because so many different skills are required within the social dynamic.
- Standing under bright florescent lights, smiling at people, and having to be social is not really my skill set, so I have had to work a series of low paying jobs and have learned to live frugally.

Social development. Within the social domain, the participants expressed a variety of heart-breaking stories that certainly affected how they evolved socially. The ideas of self-preservation and self-protection are strong in this segment and one of the participants share how the ability to discern from good versus bad people developed. Segments from these stories follow:

I have always struggled with reading body language, although I didn't know I struggled with it when I was young.

- As a kid, I knew that most people had a way of communicating that didn't rely on words and I knew I was not privy to that; I didn't know what it was, I had no idea.
- When I was young, I heard all these people talking about how I didn't read body language. I remember wondering what people meant by reading body language. I thought about it a lot, but I just couldn't figure it out.
- Not picking up on social cues leads to isolation and vulnerability, which is picked up early on. If you then perform better academically than those who are more socially adept, it just makes matters worse.
- Young kids with autism may not fully understand the downside or 'underbelly' of group dynamics until it targets them.
- I learned quickly that I needed to avoid certain social situations for self-preservation.
- I was targeted since I started elementary, so now I am very aware of potential issues and I understand the importance of protecting myself.

- For me, everything really came crashing down in high school, where the unwritten social rules become so much more complex. In the late 70's, with undiagnosed Asperger's and a world that didn't have a clue about autism, it was all I could do to keep attending school, let alone concentrate enough to get decent grades. I did eventually manage to graduate, but it wasn't until 5 years later that I started college.
- During the worst of those years I developed an eating disorder which began when I was about 14. It was a means of self-medicating back then, but it is still an issue to this day.
- It's like I am a criminal investigator. I look at certain patterns of behavior, speech, language, and I put all these pieces together to give me a framework of who an individual is. Now I can usually get a pretty good idea about a person, what benefit or harm they might have for me, from about five minutes of watching them and talking to them. That wasn't true when I was younger.

Communication Challenges. As a subtopic beneath the broader primary category of social differences, some of the same challenges with communication that were reported in the cognitive difference category rolled over to the social arena. However, and in addition, certain attributes of communication difficulty were specific and unique to the social arena. These specifics are highlighted within the following statements:

- I think that my language processing speed is probably the biggest problem for me socially. Being able to…, it's just sort of this need to express myself all the time.

- I don’t always know when to start or stop talking and I am quite unskilled at inserting myself into a conversation already in progress.
- The other issue is not knowing when it is my turn to talk in a group,
- It is the fluency. Often when I am trying to communicate with others, my brain has already marched on, so it takes a while for the words to catch up, but most people are not really that patient.
- When I first started my professional career I had a boss who said to me, you only talk to people one-on-one. You don't ever talk to people in a group so people don’t see you as very social. Which I thought was very odd. I hadn't noticed that other people were any different than I was. But it’s true, I don't talk in groups, I talk to an individual, then an individual, then another individual.
- I find that I need to ask a lot of questions to try to work out what is going on in a conversation. I appreciate that other people can find this irritating or even insulting. But the answers I get from others when I ask, even though they might seem trivial or obvious, are usually necessary for me to work out what is important (and therefore 'true') to the person with whom I am speaking.
- I don’t lie or improvise easily. I think NT people often do that without thinking, so they can more easily move the conversation along or extract themselves from it when it no longer interests them.

Non-verbal communication and body language. Although not universal, a number of the participants in this study reported significant challenges with reading and interpreting non-verbal information. Those who did not feel this was an issue were remarkably on the opposite side of it and more than one describe their abilities to read

non-verbal cues and body language as nearly ‘empathic.’ Within this range, some responded to topics of non-verbal cues by discussing their choices to interact mostly with friends. Other’s emphasized that the value put on social interaction might be overly high. One of the participants re-tells a story where non-verbal communication was blamed for something else, the dishonesty of fellow employees. Last, participants reiterate that sometimes the cost of the energy required for social interactions simply outweighs the benefit. The range of differences as well as insights from the members of this study, are highlighted in the following:

- I think I understand sometimes if someone is very angry or really happy but I don't understand always why. For example, someone might be angry with me but I might not know the reason. Do some people know why people get mad at them?
- I think I don't know social things innately. I have been married (now divorced) and I have kids, but to be honest I really don't know what to do now, at this time in my life, to initiate a relationship with someone. I can't flirt. I don't know if someone has ever flirted with me. I just don't know the rules. It’s just foreign to me, completely foreign.
- Certainly across that whole area of human experience I can't read and I don't know enough to imitate social things successfully. I can’t fake it.
- I think I lack the ability to imitate social things successfully, even when I sort of intellectually understand this is what people might prefer I do in a certain situation.
- My experience has been that there have been times that if I had the ability to process non-verbal’s that it would have been beneficial to me.

- If you cannot work out the subtleties of someone's facial expression until hours after the conversation is over, then you can effectively be considered to not be reading their non-verbal cues.
- I was in one job and periodically we receive an assessment by the leadership of the post. I remember my supervisor told me "you are doing great and people like you, but you don't really walk around. In a leadership positon, walking around is kind of important." So, I decided I would try walking around and talking to the other employees. But then, for the next assessment, my supervisor said, "People really didn't like you walking around and talking to them. It makes them feel very uncomfortable." I was obviously doing something wrong. I think when I try to act 'normal' socially, it just comes off wrong.
- Reading body language is sometimes ambiguous. It doesn't mean we can't do it though. It's just that often we find people's body language to be inconsistent or even inaccurate. People try to convey that they are fine when they are not for example.
- My conflict resolution skills are something I am still learning about over these past several years. When I was younger, conflict made me feel very unsure of myself and socially very awkward. Now I am surer of myself, but conflict is still so unpleasant to have to deal with that I deliberately try to avoid it at all cost. This isn't always a good thing.
- I can't always see social problems coming. Sometimes I am just too distracted or I am focused on other things. But if I have the energy and I can force myself to focus on the social and then I can almost always figure it out.

- When we have the energy, we are fully capable of understanding and recognizing emotion in ourselves and others. We don't lack the skill although sometimes we lack the desire.
- I think figuring out social things is easier when you take the emotional out.
- It sounds kind of weird, but I am actually pretty good at reading people. I can observe and understand people's expressions and figure out what they might be feeling in most cases.
- I've always been almost empathic, at times, in that I can figure out what people are feeling.
- I'm not sure if my ability to read people is a natural thing or something I have learned from social skills classes. But I am surprisingly pretty good at it if I want to be.
- Being able to observe and understand people's expressions and what they might be feeling is usually pretty clear to me.
- In large I would have to say that if I employ good strategies my social skills really are an issue and that is why I say that my issue with non-verbal's is **an** issue, but not **the** issue. It isn't even close to being the issue.
- I think our challenges with social things are way overstated in terms of them being important.
- I have found that if I only associate with high quality people, then my issue with the non-verbal goes away. High quality people are not looking for an excuse to throw a temper tantrum or be offended. High quality people think before they emote and all of my potential social problems go away when I am with them.

- Being with friends is far and away the number one strategy that has always worked splendidly for me in dealing with the social.
- If I only hang out with people I know well, they know how to take me.
- If I do something odd my friends don't assume I am trying to start a fight. They just know that I'm odd and that's ok with them.
- Sometimes things are blamed on my inability to read social cues when that has nothing to do with it. Let me tell you a story that I often tell when I talk to teachers about non-verbal cues. I had a job in the mid 90's s where I was a service employee and I made a lot of tips, $6000 in four months. It was a gravy train for me. I was good at that job. When I was hired my employer told me that I had to let the accountant know how many tips I got so they could withhold on my checks; so I did that. I did not see the problem coming; my co-workers were not pleased because they were not reporting nearly all of their tips. I thought you just had to do your job, follow the rules and everything would be fine. Now I know better.
- Most of the times that I have been rightly accused of having social skills problems were times when I was simply too cognitively spent to value the social over the other things in my life that were more important to me.
- Social interaction is particularly time consuming and exhausting and I hate to say this, but I usually don't get that much out of it.

With multiple and specific points to support them, using the Axial Coding process I defined within my methods, I was able to winnow, combine, and tie the Initial Coding Categories together. These left me with a foundation category and five primary categories

including: (a) Sensory Difference, (b) Focus, (c) Memory, (d) Cognitive Difference, and (e) Social Difference. As detailed within the SmartArt Images, each of these categories at this stage, also included information about how they interacted with one another and their effects on the 'whole functioning' of the individual. Using these 'effects' data, along with a similarly recursive process whereby I reviewed all of the data from its starting point yet again, I was able to begin a Selective Coding Procedure.

Selective Coding Procedure – Relationships and Links

For the third stage of analysis, using a higher level of abstraction, I explored relationships between all of the Primary (Open) and Secondary (Axial) Coding Categories by going over my memos, numerous times, examining and re-examining my Smart-Art images, and posing new questions to my participants. At this stage, I also contacted three expert professionals to ensure that the primary categories seemed accurate and to begin to establish links between them. What I found was that within each of the primary categories, there were insights in the data that I first thought of as outcomes, but later came to envision as the 'effects' of these differences within a cause-and-effect sequence. It was within these 'effects,' combined with the insights of the expert professionals, and a return to the literature, that I found answers to how the primary categories come together to provide a conclusive winnowing of this data towards a singular theoretical theme for this study.

In the effects of sensory processing, I found that sensory processing is in flux, requires constant regulation, aligns with behavioral control, and if left unaddressed, becomes ultimately unsustainable. The primary ideas within these 'effects " categories,

detailed by the way they unfolded for their relationships in my mind, are depicted within the following section.

Sensory Effects and Relationships

The following points stood out for their applicability to sensory processing and their relationship to sustainable functioning.

- My strategies to deal with sensory issues are always in flux, have been for fifty years, and they are highly dependent on the amount of energy I have to process them.
- Other people see my degree of deliberation about all these sensory things as ridiculous. But to me, it is necessary, because I can't get in that situation where I am going to spend all my functional energy, then not be able to go to work.
- It is like if you only had one gallon of gasoline to drive around on all day. Earlier in the day you'd have more options of where you could drive to. But later in the day, as you've been emptying the tank, your options would narrow considerably.
- Sensory processing is a part of my regulation system. I don't think most people understand that.
- Noisy, crowded, visually distracting workplaces may be cost-effective for the general population, but they are very detrimental to getting any work done for me.
- I have had to leave work in the past because the environment was so over-stimulating that I was becoming physically ill trying to block it out.
- A busy environment, particularly other people talking, is not just distracting, but it's actually painful and exhausting to experience if I am trying to work.

- This continual over-stimulation disrupts sleep, impairs my immune system, and is ultimately unsustainable.
- In one of my jobs I was just so over-stimulated and tired that I kept getting sinus infections until they got so bad that I had to quit.
- My sensory issues assert behaviors that I don't want to come out. I don't know why they are happening, but they are happening.
- Sometimes when my kids are being rambunctious and loud, I respond. But then I am left feeling like someone else just barked out at them. We have to truly pay attention to that stuff.
- The 'invisible' nature of these issues in ASD leads (NT) observers to assume that those with ASD have a lot more control over their behavior than is really true.
- My sensory issues assert behaviors that I don't want to come out, that I just can’t let come out.
- We have to pay attention to our state of regulation or we will be forced to act in a way that we don’t want to act. We really have to pay attention to that stuff much more than most people.
- Sensory differences dramatically affect our performance as we are creatures in a moment.

Focus Effects and Relationships

With the central idea that focus is less taxing when interest-based, I reiterate the following points to help the reader understand how I determined that focus relates to sensory processing, memory, and ultimately cognitive performance.

- I've always felt anxious about learning things for which I have little interest. I often just can't do it unless I can find something in it that interests me. If I am not in some way intellectually engaged then I just shut down and my thinking stops.
- Most of the autistic people who have been able to incorporate their interests into a successful career were very fortunate. My interests were never in line with what someone who was hiring actually wanted, so I have been forced to take a number of part-time, menial jobs to support myself.
- When working menial jobs that don't interest me, I fatigue quickly. I just don't have enough energy to keep doing something that isn't interesting to me.
- I find that I need to keep things very simple to avoid the need to multi-task. I am very good at breaking things down, but find it difficult to make my choices and focus on one thing. It reminds me a lot of a big equation in algebra, how it breaks down. I have a lot of boundaries in place so I can keep focus in the one place I need it most and to do this, I go for the simple if I can.

Memory Effects and Relationships

Memory and its ties to the other categories seem best summarized and the relationships most pronounced within the following ideas.

- Memory - Ah, I remember it well. I have always had a very good memory for what might be called 'extraneous' facts surrounding a particular circumstance, so if I see an actor in a show and I can't immediately remember where I saw them before, I will be able to remember that they were wearing a green sweater

previously or had blond hair. Not a lot of help at first in working out where I have seen them before, but every little bit eventually helps.

- I have noticed that my memory does compensate for deficits in other areas. For example, as I stated, I have a problem with fluency. It is really a hindrance to my ability to express myself. However, my good memory helps me to retain a large amount of vocabulary with which I can compensate.
- I have always been interested (obsessed even) with and can easily remember facts and the provenance of facts - where they came from. I think these help me relate to the world.
- I have exceptional memory for specifics, sort of within this narrow window; but within my 'window of memory,' I can recall every detail to the degree that I can often re-experience the memory and sometimes even pick up on details that I missed when I was actually there in replaying the memory. On the other hand, I don't remember the general, across all of the 'windows,' as I think others seem to do. For me, all of my memories are quite specific and relate to the particular, versus this broader set of 'fuzzy abstracts.'
- I am able to successfully compartmentalize my memories in ways that I don't think others are able to do. Because I do this, I sometimes feel as if I only exist in the here and now, that my memory for the past might not actually exist, although in my thinking mind I can rationally remember that it must.
- While we all seem to have very sophisticated sense-based and/or visual-based memory systems, we don't all seem to have the ability to easily remember

language. I am likely to remember everything about a particular situation except for what was said.

Cognitive Effects and Relationships

As both end-state and beginning state, the relationships between sensing, focus, memory, and cognitive evolution within the ASD individual are depicted within the following primary ideas.

- My ability to hyper-focus on the specific, recall details, recognize patterns and rhythms, and envision the big picture are pronounced attributes that should be useful (assuming the sensory environment isn't too over-stimulating), to many areas of science and technology.
- Although not all those on the spectrum are like me, in addition to my visual skills of pattern recognition, I am able to quickly pick up on new languages, including regional dialects. These have given me a significant edge in my field.
- Knowing that we are, in general, more visual in our thinking, why are we not tapping into communicating through visual languages?
- It seems that our problems with fluency and verbal communication skills are often our greatest set-back.
- I believe that we also seem to be thinking slower because we are taking into account more specific variables and more information in our thinking.
- Because I am wired to hyper-focus on the specific, and this allows me to form a more complete big picture, I can't easily multi-task. I have a hard time seeing the steps and I get overwhelmed when I try to think about them all.

- When staring something new, I learn best when I work from a series of specific examples. Once I have accumulated enough of them to form the big picture then I can envision the outcome or result.

Social Effects, Relationships, and Outcomes

As a culmination of all that has come before it, I believe that ties between social skills, the foundation category, and the other four primary categories are depicted in the following.

- There are certain types that I can't get along with. They are antagonistic and nasty and inauthentic and even though I try I just can't get along with them, so I have learned to protect myself from them.
- I recognize that there are people out there who can't tolerate me, who I am, or my quirkiness. They are not forgiving at all. But once I have recognized that in a person, I know to steer clear of them.
- I see social interaction as a particularly labor intensive activity, in and of itself. But place me in a complex sensory environment, such as a cocktail party or a busy work setting, and force me to make small talk, and I just won't have enough energy to do it.
- Even though I am quite verbal and I have a large vocabulary, my communication timing seems to set me apart socially.
- I think differently, I have a different experience of the world, and I am often not interested in the same things as other people. Is it any wonder then, that my social interactions look different to those outside of my circle of comfort?

- I have a few close friends and quite honestly that is enough for me. When I am with my friends, I communicate more easily, my sensory needs are respected, and I am in my tribe.

Once again, and with much help from those in the study, both initial participants and expert professionals, I was able to use the same recursive techniques as those employed in open and axial coding, until I finally arrived at what I believe to be the central or core categorical themes or processes that this study uncovered. With the help of my research advisor and several of the participants, I developed the following model to demonstrate my understanding about the theoretical relationships between the primary research topics I discussed in the Axial Coding section and to highlight my basis for and the assumptions behind my proposal for a new Theory of Sensory-Cognitive Difference as perhaps the most complete explanation about ASD for this group of participants. My summary for this model, comprised of several different points of reference from above and stated with my own voice, explains how I came to view the core features, relationships, and the overall findings shared by the participants of this research. That summary follows:

> Understand that because of my significant sensory differences I am on a different path. Because I am on a different path I have different interests, make different observations, see different connections, and these differences dictate my focus. Because I focus on different things and I observe relationships between things differently, I remember different things and I remember them in a different way, which is often very specific, but not usually very general. Because what I observe and remember about the world around me is different, I get to different places in

my thinking and different things have value to me. I see patterns, oddities, and anomalies; I hear and sense rhythms, and within these, I am sometimes even able to sense the metaphysical in ways that I think are unique to me and those like me. These cognitive differences are recursively tied to my sensory differences and often give way to how I think, feel, and sense. Combined, these give me a very different big picture about the world. As a result, I am cognitively evolved to be socially different, so that even though I may struggle to communicate my thoughts, I am very aware of the social and I would often rather observe than participate. I find social and cognitive value within those who accept me and fully appreciate me for all of my differences. The person I am socially, how and what I think and value, what and how I remember, and what holds my interest and focus, all influence how I perceive the world and process new sensory information, and over time, these differences have made me who I am, a very different yet completely whole individual.

Figure 7, depicts the culmination of the results of this research and depicts the study's proposed theory of Sensory-Cognitive Difference, which is a visual representation of the above statement.

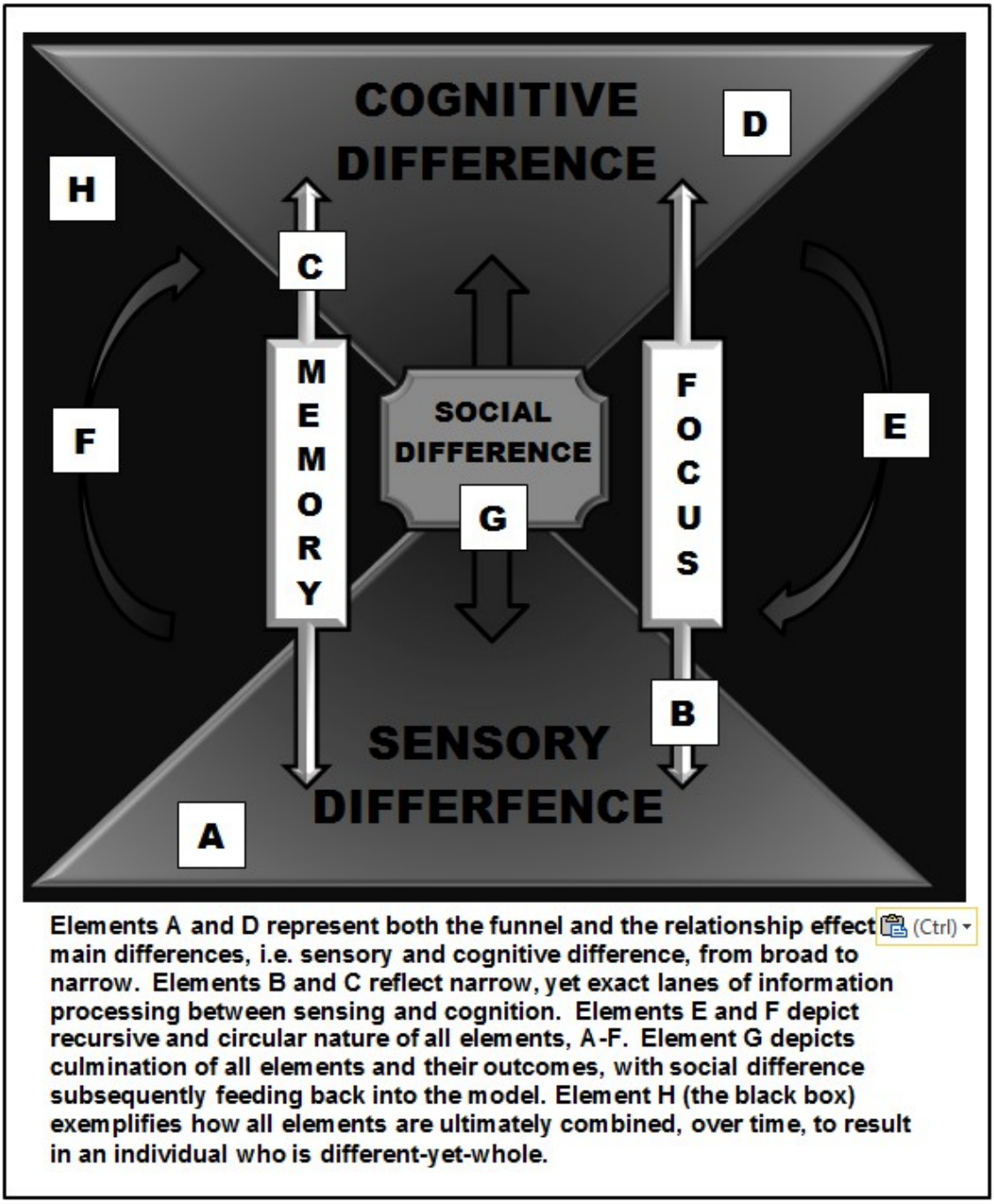

Figure 7. Proposed Theory of Sensory-Cognitive Difference

Summary

With the intent to more fully understand how intelligence, cognition, and sensory processing differences might interact and play out for those with ASD, I conducted a qualitative inquiry within the theoretical framework of social constructionism to explore the perceptions and experiences of 14 adults diagnosed to be on the spectrum of autism, and three expert professionals who are both diagnosed with ASD and work in the field. Using an extensive review of existing literature as my guide, I analyzed nearly 300 pages of raw data within a grounded theory methodology to arrive at what I believe could possibly be a more comprehensive Theory of Cognitive Difference for those with ASD.

My evolved theory came out of a three-stage data coding process that began with 52 initial, open-coding categories which were condensed into one foundation category and five primary categories that included: (a) sensory, (b) focus, (c) memory, (d) cognition, and (e) social. Finally, within a third and final stage of analysis, using compiled data, I established an 'effects of' category through an axial-coding procedure, which led me to my understanding about the relationships between the primary categories that ultimately made up the Theory of Sensory-Cognitive Difference. I believe the theory is best described within the following core ideas.

1. The construct of intelligence and those of wisdom or discernment are not equal, at least for the ASD individuals reflected within this study. Within discernment, the favoring of a harmony of ideas over a model of consensus is recommended. This leads to a need for more openness and inclusivity for those with AS. For those who are much lower functioning or non-vocal, it is assumed by those in this study that some environmental injury has occurred, within an otherwise "autistic,"

neuro-developmental, epigenetic lineage. Within discussions about difference, there appears to be considerable diversity amongst those with ASD and at least two very strong style differences contrasted as either the "visual/sensory people" or the "verbal facts people." These differences for this group occurred irrespective of the autism or Asperger diagnosis, were weighted more heavily to those who are "visual/sensory" (only three of 17 were verbal facts people) and this distinction appears to have significant implications for several of the other categories.

2. Sensory processing differences, likened to an "eight lane super-highway" (with those who are 'neuro-typical' presumably working from a single lane highway of sensory input), have caused pain, anxiety, fatigue, and perhaps even secondary post-exposure trauma for all of the members of this study to varying degrees. Within this analogy, both hyper- and hypo- responding have been the result. Additional and specific emphasis for sensory dysregulation, based on sounds, lights, touch, texture, taste, and smell all appear worthy of consideration for their effects on energy, focus, memory, cognition, and ultimately sustainability for those in this inquiry. Relevant specifics for these subcategories of sensory responding follow:
   (a) For those with ASD in this study, there existed an extreme pattern of responding to the sensory sensation of sound that was either highly hyper-sensitive (i.e. feels pain in ears) or is remarkably hypo-sensitive (does not hear emergency warning systems) and these seemed to align with either the visual or the verbal learning style pattern, respectively. Moreover, those who were

'verbal facts people' and also not particularly sensitive to sound (although quite hypo-sensitive in some cases) seemed to perform better academically.

(b) Those who were sensitive to sound (the visual learners) were similarly sensitive to certain lights. Florescent and LED lights were particularly offensive, usually causing headaches and, over time, performance degradation. For those without light sensitivity, a similar, extreme pattern of hypo-responding was reported in several cases. As was true in the above instance, those with hypo-responding experienced fewer problems in school and had less sensory effects in the workplace.

(c) Issues with touch and texture were reported by more than half of the respondents in the study, with some of them experiencing pain or alternate site sensation when touched lightly. Those who felt the sensation in a place other than where they were touched, described needing to learn how to process touch from childhood, which ultimately has allowed them to be able to manage touch or even enjoy being touched as adults. About half of the study's participants reported issues with tactile sensations pertaining to food, with two of them fairly limited by what they could eat. Several disclosed the need to wear certain fabrics or textures of clothing, although as adults, I wondered how many of them instinctively choose clothing by their fabric and therefore, didn't report, or perhaps even recognize a problem with skin sensitivity. No specific pattern of learning style difference seemed to be associated with these differences.

(d) Tastes and smells were related to energy levels for those in the study, with the reporting of being able to handle strong tastes or smells better when rested. Others reported appreciating or even enjoying heightened olfaction and taste sensations. Again, sensitivity in this area did not seem to be aligned with either learning style or other areas of hyper- or hypo-responding; in other words, one could be highly sensitive to sounds or lights, but then have little to no awareness of, or heightened reactions to strong smells or tastes.

(e) Sensory processing differences resulted in challenges with coordination, among other things for the majority of the participants. Discussions about these suggest that in states of extreme sensory overload, complete impairment of certain motor functions might be possible, with these 'motor shut-downs' contributing to issues with safety.

3. Strong, interest-based, hyper-focusing ability for the singular, contrasted by an inability to focus on the broad or general existed for those reflected within this research. Accordingly, this has led to difficulties with multi-tasking, but allowed for extreme focus which ultimately facilitates the ability to see the big picture. The participants' singularity of focus was reportedly driven first and foremost by interests; then focus was directed to include things that were novel, odd, or disturbing. More important though, was the finding that given the effort required to filter the sensory environment, interests became one of the primary bases for filtering. A literal inability to focus on that which isn't interesting was the result of trying to focus amidst a complex sensory background. Furthermore, because focus was not general in nature, but instead very specific and built upon the

particular, some of the cognitive differences reported seemed to be the result of this focusing pattern. Although expected, a learning-style pattern (visual versus verbal), was not specifically identified for this area and even for the members of the study who aligned as "verbal facts people" interests and focus for visual patterns often prevailed; the "verbal facts people" did seem to have stronger ability to focus and discern rhythms and sound or language-based patterns however.

4. Similar in its evolution to the aforementioned category, excellent long-term memory, that is usually very specific and detailed, although not very general, appears to have evolved for those who participated in this research. With poor short-term memory, the participants experienced memory that was beyond that of most NT's for the specific and reports suggest that memory usually occurs within what several described as a narrow window of observation that is nearly perfect in detail. For almost everyone, even the "verbal facts" people, visual memory was especially sophisticated. Some had even developed the ability to see and remember freeze-frame photographs of a particular event, which could then be stopped or re-played at various speeds. All those reporting these abilities described them within the metaphysical for their ties to quantum physics. Other perspectives within memory suggest, that for some, memories can be easily compartmentalized, although this might lead to aspects of difficulty with object-permanence, especially for those who were often in a new location for work. Although learning style seemed to play out in the other categories, surprisingly, both the verbal and the visual learners in this study seemed to have strong visual

memory, although the "verbal facts people" also remembered everything that was said, in addition to the other visual and sensory memories they had. Some of those who were exceptionally visual seemed to also have strong, three-dimensional spatial memory as well, (although this seemed quite to the contrary for the "verbal facts" group). Given such a unique and highly specialized memory system, the majority of those in this study had often been viewed by others as highly intelligent, in spite of other areas of difficulty. Memory also seemed to play a fairly significant role in compensation of skill deficits although those in the study reported that their memories were 'filled with holes.'

5. Cognitive differences, particularly within the seeing or sensing of patterns, finding or recognizing anomalies, attending to details, and/or re-creating and imagining the 'big-picture' from the assemblage of parts were the most remarkable areas of cognitive difference for those in this study. These appeared to result in what many described as slowed processing speed and challenges with articulation of idea to conversational output. In line with being able to easily see "the big picture," most indicated that new learning required learning from the specific instance to the general, until the big picture could be created. From there, mapping a path and detailing the steps to get from point A to point B in tasks were reported as challenges; although having a narrowed focus and the ability to pay attention to the singular helped to some degree once an organizational list was created. Given what appears to be a very different manifestation of cognition for those in the study, most felt riddled with areas of significant cognitive aptitude amidst debilitating cognitive deficits. These were blamed for poor performance

and slowed responding. Challenges in communication within an inherently linear system of relay were universal, even for the "verbal facts people." Interpreted within the tradition of the cyclical and recursive nature of "all our mental abilities" (Glass & Holyoak, 1986, p. 1), the participants articulated how their sensory differences, narrow but thorough bands of interest, and specific as well as highly detailed memory systems led them to different places in their thinking. For the "visual people" in particular, cognitive skill differences had not lined up with standardized assessments of intelligence or performance ability, leading most to feel like existing systems of evaluation were "rigged" against them. This led to a variety of opinions about interpreting intellectual abilities for those who are more impaired in their verbal or motor demonstration abilities and opened up discussions about the possibility of multiple and alternative forms of visual or sensory different aspects of cognitive performance that are not reliant on fast responding or verbal output. To give clarity to this idea, according to those in this study, it seems that indeed "a picture is worth a thousand words," but the words required to relay a full-blown sensory experience that has been focused to exquisite detail then remembered in similarly sophisticated clarity is simply too complex to put into language. This led those in the study to view processing within traditional verbal communication systems as unnecessarily linear, and given differences between cognitive strengths and weaknesses, there seemed to be valid indicators to support alternative forms of cognition for some individuals with ASD. Finally, as what almost all felt was their primary feature of disability, speaking the ideas that were in their heads, the topic of speculation opened to

suggest that some non-vocal members of the ASD community (often deemed to be low functioning), might in fact experience an even more extreme difference in cognition, memory, focus, and sensory responding that ultimately leads to a state of hyper-visualizing that competes for resources at the expense of language and motor skills. In particular, this idea emerged from three members of the study, who had biological children that were on the spectrum also, but were much lower functioning than they were themselves. Finally with ties to other categories, it was suggested that the additive nature of cognition, memory difference, focus, and sensory difference, are, in general, simply too expansive to articulate outside of discussions with those who are not on the spectrum. Furthermore, continuous processing is exhausting from a cognitive energy standpoint, and all of the members of this study had to work very hard to conserve their cognitive resources for use in necessary tasks.

6. With little surprise, those in this study identified with a number of challenges in processing social information. For the first of these, remarkable childhood histories led at least some of the members of the study to view social interaction, first and foremost from a position of safety and self-preservation. Only then could they view it form a position of value. Participants reported a variety of social communication issues that they felt were part and parcel to the majority of the challenges they faced in social interaction. These included issues with processing verbal communication in noise, timing responses, knowing when and how to enter or exit a conversation, cognitively tracking the conversation, and sharing interests. Most felt that the majority of social interactions they were accused of being “bad

at" were riddled with inauthenticity, and small-talk. Described as *a difference*, but certainly not *the difference*, all participants also described some challenges with reading and interpreting non-verbal cues. Strategies to addressing social differences were detailed by those in the study and these included reading people as either good or bad, associating mostly with good people or with people who are friends, and coping with social difference, particularly in unfamiliar social arenas, by choosing varying degrees of self-isolation. Final thoughts were shared tying the social to the above categories for relationship to the use of energy and cost-versus-benefit value assignment for the 'tasks of socializing.'

With these main ideas and the relationships between them established, I arrived at the conclusion, that at least for the members of this study, differences in sensory processing, focus, memory, and cognitive processing, all crossed, interacted, and co-mingled to explain a very different form of sensory-cognitive evolution and this resulted ultimately in thinking and social interaction differences. From this, I proposed my Theory of Sensory-Cognitive Difference for its application to understanding how the relationships between intelligence, cognition, and sensory processing might be explained for those with ASD. The implications of these assumptions and resultant recommendations are detailed in the following discussion.

CHAPTER V

CONCLUSIONS

Implications of the Proposed Theory

To give preface to this section, I believe that the reader must first ask the question: "Is being on the spectrum somehow worse than not being on the spectrum, especially for those who are high functioning?" Based on what I found in this study over the past six months, I have come to believe that as educators and mental health professionals, we need to be asking ourselves if we are doing the best we can for those with ASD to raise them up into healthy, happy adults who have the skills, self-knowledge, and resources to become well-adjusted contributing members of the future world.

In thinking about that for myself, I can't seriously answer in the affirmative, especially for the children I have worked with who are diagnosed to be on the spectrum of autism. Moreover, I can say that it is clear to me, especially having conducted this study, that we must do something dramatically different for today's youth with ASD. Because right now, driving them through a deficit-based system that only identifies and strives to remediate what they can't do in an effort to normalize them is tantamount to losing them. We see these youngsters in our classrooms, in the main-stream media, and even within our own families, but for those with ASD, I believe that we still just don't understand enough about autism to know what to do differently. Therefore, with a hope

that is perhaps too naïve and too optimistic, I would like to put forth an alternative Theory of Sensory-Cognitive Difference that details how I believe (perhaps in an ideal world) the implications of this study could be understood, implemented, and carried out.

Contributions to the Literature

First and foremost, because I believe that nothing can or ever will change without increased knowledge and understanding, I think that this study offers some of its most valuable contributions by filling some of the gaps that exist in the evidence-based literature across the broad topics of intelligence, cognition, and sensory processing in ASD. Therefore, in a return to the summary of literature for this research, I propose that this study be considered for its insights into the following topics.

Thoughts about the Rise of The Autism Diagnosis

While the cause of autism is still widely disputed, ASD is on the rise (CDC, 2014; Boulet et al., 2011). But, according to several of the participants in this study, "injury" in what should otherwise be considered a neuro-diverse or different form of development for those with autism might actually be the cause for the increasiong numbers. In other words, participants in this study suggested that autism itself is a normal, albeit neuro-diverse, aspect within the general population, and these individuals should not be viewed as disabiled, but instead as different. However, for those who are more severe, the notion of *injured autistic* applies and, therefore, needs to be addressed. For this reason, continued research on both environmental and epigenetic causality must continue. However, this should be done within the idea that perhaps not all autism should be viewed through a lens of disability, but instead,hould be seen from the standpoint of happy, healthy functioning of the neuro-diverse individual.

Effects on Learning and Socialization

Second, the conditions of autism might have a significant and negative affect on socialization and learning (Risi et al., 2006), especially when viewed through the lens of what is neuro-typical; based on what those in this study had to say, it is possible that the over-emphasis on what is socially normal or on what is normal in learning might overlook some valuable insights from those with ASD about what should be considered as normal for both socializing and learning in ASD. Those in this study reported that shallow conversations with inauthentic people are simply are not worth the cost. Additionally, it seems that a different form of identity development might relate to key social differences in ASD. Furthermore, for those with ASD, it seems possible the construct of "learning" might indeed need an overhaul to include definitions of learning within the interest-based focus, specific memory systems, and cognitive differences that seems to have evolved within the conditions of autism.

Intellectual Disability in Autism

Regarding the topic of intellectual disability with what those in this study reported, especially those who self-aligned with being "very visual," it seems possible that IQ scores are not at all accurate in ASD. Two of the participants in this research who had completed doctoral level studies had been tested with IQ scores below 80. Clearly then, the construct of intelligence, at least for those with ASD, might be worthy of another look. Furthermore, assumptions about prevailing intellectual disability (McMahon & Ritvo, 1989; Bryson & Smith, 1998) might merely be reflecting the side-effects of an outdated construct on intelligence for those with ASD.

Existing Cognitive Theories

A number of unique cognitive difference theories that have attempted to explain autism over the years, though none appear to be universal (Rajendran & Mitchell, 2007). However, based on findings from this research, the theories of executive functioning (Ozonoff et al., 1991), weak central coherence (Happé et al., 2001), systemizing (Happé et al., 2001), and the emerging hyper-systemizing and responding theories (Baron-Cohen et al., 2007) all seem to have a piece of the equation. But, like strings on a guitar, I see the addition of this study's proposed sensory-cognitive difference theory is needed to round out the explanation of autism for a more harmonious big picture. Unlike previous studies, this study focused on strengths. Then it added as its starting point a very different and unique form of sensory processing, filtered by interest-based observation, remembered through detail and specifics within a narrow, but perfect, window that evolves into a different form of cognition, which culminated in social difference and cycles back into a different sensory perception. The proposed theory of sensory-cognitive difference has parts of all of the existing theories embedded within it, at different stages; but I believe that because no one has ever looked at autism for what it actually is and, instead, viewed it for what it isn't or what makes those with ASD less than, this has prevented others from seeing the big picture.

The Extreme Nature of Sensory Difference

Clearly, within this proposed harmony of models, there is universal agreement that sensory processing difference underlies the conditions of autism (Marco et al., 2011). However, based on the findings of this study, it appears that what has been lacking to date is an understanding about the extreme nature of difference that those with ASD

experience. Moreover, it is still very unclear how sensory processing difference impacts cognitive evolution within an individual. According to the members of this study, that difference is so great that it cannot be explained in words. In turn, this seems to have prevented clarity about what sensory difference actually is or how it plays out in its role in focus and the development of memory within the learning environment. But with a sensory difference fact confirmed, much more research is needed on how to adapt the environment to meet the needs of the individual, instead of the other way around. Although not clearly a finding of this study, in talking with the respondents about their sensory difference, I got the sense that sensory differences had even resulted in trauma in some cases. While this study did not explore that particular point in detail and, in fact, it didn't surface until the write-up was nearly complete, in hindsight, I think additional research in the area of sensory trauma and its effect on cognitive development seems like a worthy cause, especially in attempts to address the needs of those affected individuals who are severely impaired or for those who seem to be in constant pain.

Hyper- and Hypo-Responding

Within the sensory processing research either hypo-sensitivity or hyper-sensitivity are heavily reported (Rogers & Ozonoff, 2005). However, with little to explain these or tie them to any kind of meaningful pattern of responding (Ben-Sasson et al., 2009), using this study as a starting point, more research could be done to determine if there is, indeed, a higher pattern of hypo-responding in those who are inherently the "verbal facts" people and, similarly, a more extreme pattern of hyper-responding for those who are more visual or sensorial in their inherent learning-style make-up.

Addressing Sensory Differences First

Within the proposed strength-based sensory-cognitive theory of difference that came out of this study, I envision that more emphasis will need to be given to what those with ASD do differently and to what they can do well. To address sensory difference first, it appears to make little sense to attempt to teach those with ASD anything until they are safe from the assaults of their sensory world. Based on the respondent reports in this study, those with ASD should never be forced into settings where noise is painful for them; nor should they have to exist and function under fluorescent or LED lights. Attention to touch and texture must include the possibility that touch is painful or confusing and should, therefore, be avoided. Furthermore, the sensory support diet of any individual with ASD should take into account such things as clothing preferences and the ability to be in a setting that isn't confounded by strong smells. Those with ASD should never be forced to eat foods that don't agree with their palate. As stated by so many in this study, until those with ASD understand their sensory processing systems and feel safe, they won't be able to think or learn.

Cognitive Difference

To address cognitive differences, it appears that research and development is needed on a teaching method that is particular to the skills of: (a) hyper-focusing on the interest-based singular; (b) remembering with acute clarity the details within the narrow; (c) seeing and/or creating the big-picture; (d) recognizing patterns, rhythms, and anomalies; and (e) processing on a different time clock for intuitive solutions to problems. This will require a shift in teaching those with ASD, to do much more than ABA therapy and inclusion in the classroom. By expanding research into the areas of

attention, focus, cognitive difference, and processing speed, new research-driven teaching practices will ultimately evolve. In addition to supporting and teaching sensory awareness, educators in both k-12 programs and in higher education will need to be taught how to truly understand and address cognitive differences for those with ASD, which will require autism-specific training programs that specialize in preparing educators to be able to meet the cognitive difference needs for individuals with ASD. Increased support and training in self-advocacy as improved clarity and legal supports will also be required for change to occur in the workplace. Given what is now known in the fields of behaviorism, cognitive learning theory, the cognitive neurosciences, and sensory processing theory, the only universally accepted and research-approved therapies for the treatment of ASD continue to be found within the traditions of behaviorism (Lovaas et al., 1965; Kasari & Lawton, 2010). This needs to change, according to the findings of this study. More specifically, based on the participants in this inquiry, it appears that the ones who have been professionally successful (i.e., able to support themselves and live independently), all found a way to work through their sensory challenges and find employment within an areas of strength, interest, or passion. However, for those stuck in menial jobs or jobs well below their training, sensory issues and a lack of vocational support were cited as reasons for not being professionally successful. To address this, both educational and vocational training must first address sensory issues by helping those with ASD learn to manage their differences, advocate for them, and seek reasonable accommodations in the workplace. As indicated by some in this study, laws to mandate change for those with ASD around sensory issues are also needed. Then, once sensory issues have been addressed, formal identification of

strengths, teaching toward those strengths, and support for the alignment of strength-based job placement with training in the workplace is needed.

A Complex, Systems-Based Understanding

Given the complex nature of the proposed theory of sensory-cognitive difference, research in the field of neurobiology will need to be considered within more complex, systems-based ideology. It must be pursued within a more holistic, strength- and difference-based world-view on autism as proposed by Rao and Ashok (2013).

Alignment and Difference to Neuro-Diversity Theory

Very much in line with the recent neurodiversity theory being forwarded by many of those with ASD, the theory of sensory-cognitive difference , as proposed, gives specificity to a different form of epigenetic evolution for those with ASD. However, unlike the neurodiversity theory, this theory also recognized the possibility that environmental assault in recent decades might also have injured many ASD individuals. Therefore, rather than accept all forms of autism as part of the normal neuro-diverse continuum, this theory, as proposed by some of the respondents within, recommends continued research and intervention (especially within the fields of medicine and occupational therapy) to support and alleviate the distress of those who might be otherwise on a different neuro-diverse path.

Assumptions and Implications for Practitioners

From its outset, this study aimed to address gaps in the evidence-based literature by exploring the topics of intelligence, cognition, and sensory processing for the purpose of establishing a theory that could effectively challenge existing assumptions in the

literature and provide alternative recommendations that are problematic for those with ASD. Therefore, to give further clarity and depth to the proposed theory of sensory-cognitive difference, the following discussion and recommendations are provided for the purposes of more completely explaining the theory while challenging assumptions and filling gaps.

Definitions of Autism

The first assumption I challenge within this theory is that a universally agreed upon definition of autism exists. Within the proposed theory, it is clear to me that the conditions of autism are, indeed, on a continuum, although the learning styles of *verbal facts people* versus those who are *visual/sensory people* appear distinct. These do not, in my mind however, constitute the primary differences first articulated between Kanner and Asperger, and they are certainly not (at least for the members of this study) reflected within the diagnoses of autism or Asperger syndrome. Instead, I see them as a different starting base for learning that is probably genetic. In the case of ASD, which I am beginning to see as one of specialization, I think these style differences have possibly evolved to be even more divergent in ASD than they are across other NT populations. My theory, therefore, suggests that there is no difference between the cases of Kanner and Asperger (recall that I read some of the original case studies in preparation for this study), but that the primary differences we see across the continuum of functioning as high or low are, instead, differences of ability for managing sensory differences and for *vocalization* with the possibility that for those we are now describing as low-functioning or nonverbal, these individuals might simply be too specialized within the visual and sensory domains for vocalization and efficient motor planning (based on opinions of

three of the participants in this study who are also parents to lower-functioning children). For this reason, much more needs to be done to understand sensory and learning style differences for individuals across the autism spectrum.

The Prevalence of Intellectual Disability in Autism Spectrum Disorder

Second and perhaps the most problematic assumption I challenged, is that intellectual disability continues to be assumed for individuals across the autism spectrum. In line with the above point and within the proposed theory of sensory-cognitive difference's position that sensory and cognitive development have evolved together into a very different form of intelligence, I believe that it is anyone's guess even as to what intelligence actually is for those with ASD. Therefore, at present, I think we lack the instruments to measure it consistently and because our existing measures fail to include those things that are specialized in ASD within the core construct of intelligence, I think that intelligence and, likely, performance in ASD cannot be accurately measured. With the added problem that most testing environments are likely not adapted to the basic sensory needs of individuals with ASD and, therefore, that those who are most affected possibly can't even think while being tested, it is my recommendation that we throw out the baby with the bathwater as it pertains to assessment for those with ASD and rely, instead, on our basic nature of discernment in starting over in how we think about intelligence in ASD. In my career, I have heard at least 100 times that a particular child is "just so smart, but his test scores are very low" and yet, these same insightful educators who picked up on high ability are still forced to rely more on the scores than on their instincts, given special education requirements. In all cases, a presumption of cognitive competence needs to be assumed for those with ASD, until we have the ability to assess

those with ASD for their unique abilities and differences. I do believe that there are differences in intelligence across the spectrum and that these are likely to be at least as extreme as in the NT population, but until we understand them, we will be unable to sort intellectual disability from giftedness. I also believe that what we now constitute as intelligence might actually fall away completely once we begin to more fully understand sensory and cognitive difference for those with ASD. For all of these reasons, I call for the abandonment of formal assessment data, for use in placement decision-making, for all individuals with ASD who score below 80 on formal IQ tests. For these individuals, I recommend that instead of IQ-achievement data, first-person reports by those familiar with the individual be used to develop individualized learning plans to address both strengths and needs.

Views on the Evolution of Behavior and Cognition

In line with the previous discussion, I also challenged developmental world-views on the evolution of behavior and cognition for their ability to aptly capture cognitive abilities and differences for those with ASD. Holding to a definition of cognition that includes all our mental abilities as a species, I contend, given the results of this study, that within behavioral, cognitive, and even neurobiology traditions (because deep cognitive processes cannot be observed, measured, or replicated) the cognitive-behavioral traditions with their emphasis on a linear and normal trajectory of development are not relevant for those with ASD. More specifically, the primarily language-based tasks of short-term verbal memory and spoken or written recall that have historically been heavily associated with learning and, thus, vocational outcomes may no longer predict vocational success across all fields in the future, especially for those with ASD. Therefore, I believe

we, as a society, must consider new and alternative, non-linear, and non-verbal aspects of learning and performance for our economic sustainability in general, and more specifically, for those with the special talents of autism. It is clear to me that our current educational trajectory, especially for the millions of children with *autistic* sensory-cognitive differences, is not adequately preparing these individuals for careers in the STEM fields where they are most likely to find success. For those with ASD as the largest growing career sector in the world, I believe it is possible that a shift in education to focus on preparing students for entry into STEM is what both the massive numbers of those with ASD and the job market of 2020 will require. This is not to say that all individuals with ASD should be forced into the STEM fields, but instead, the door should be opened for them to try if they feel interested and inclined to do so, and educational training programs should align closely with that mission.

Views on Sensory Difference

An additional problematic assumption I challenged in Chapter II was that the way humans perceive and process sensory information from the external world is the same for everyone. In this assumption, I referred to the original works of Jean Ayres. Now more than ever, with the voice of the participants with me in this research, I would like to reiterate my belief that the real value of Ayres' sensory integration theory was that it scratched the surface of understaning how truly complex, pervasive, and multi-dimensional the effects of sensory processing are for all levels of cortical processing and individual cognitive evolution. With the sensory systems now recognized for their involvement, at the neocortical level and in nearly all levels of cognitive processing, it is no wonder that the demonstration of intellectual ability or learning and performance, as

they are currently defined, seem to be dramatically affected by sensory processing difference for the particpants in this study. Within this finding, I recommend that the field of sesory proceessing theory be re-opened and re-examined for its relationship to the the very different evolution of sensory processing that seems to have occurred for those with ASD.

Views on What is Normal

Similar to the argument above and of paramount consideration within this research is the final question I posed in the opening of this summary, "Is autism, especially in its higher forms of functioning, somehow worse than being normal?" More specifically, I am asking, "Should everyone be normal?" Within the existing developmental and ontogenetic world-view, those with ASD are dissected and classified for their deficits, while this study suggests that a much more *whole-istic* strength-based view will undoubtedly reveal both challenges and strengths that are the *normal* for those with ASD. Within this view, a much broader definition of normal must evolve, and the arrogance of trying to make everyone alike must be abandoned. To do this, teacher training and educational programming must ultimately move away from discussions about bringing every child up to some developmental normal and instead, expand into broader discussions and deeper understanding about diversity and the need for inclusive, strength-based identification and talent development.

On Being Whole

Through advances in neurobiology, researchers continue to claim to be able to see visible differences in the brains of those with ASD. But without the ability to analyze these differences within their broader, systematic global functioning as a *whole system*, a

large number of disconnected brain differences continue to be explored as *abnormalities*. Within my proposed theory of sensory-cognitive difference, I suggest that, of course, those with ASD will have differences in their brains. In fact, with such significant sensory and cognitive differences, the reverse would be impossible to imagine. But, I would like to propose the idea that until we consider those with ASD against themselves (i.e., gather data about what is normal in autism), there will never be a situation in which we can determine what is normal or abnormal for those with ASD. Interpreted through the lens of the combined theories of causation that draw both from epigenetics and the environment (namely, toxic loading theories that damage those with ASD), I believe that we cannot look at ASD as a dissected variant of normal because in so doing, we miss the critical "finding and stopping what is damaging our kids to these more severe levels" (Participant IV). It is, therefore, time that we start looking at those with ASD from a fresh, holistic *whole-person* perspective.

Finally, it appears to me, that those (at least in this study) have grown up with extreme sensory difference. They have focused on different things and as such, they have developed a wide variety of different interests and knowledge. Moreover, they have retained different and very specific memories of their growing up experiences that far exceed my own memories (in specificity and detail) and those of anyone else I know. Over time and perhaps also as a point of genetic origin, these differences evolved into some very specialized and different cognitive abilities that the rest of us NTs simply don't' have and can't learn. Recursively, I believe these also affected sensory perceptions, giving the individuals in this study a completely *alternative world-view* which, undoubtedly, plays out differently in the social arena. But more importantly, as I

have also learned these past six months, in spite of their differences, all of these individuals are whole just as they are and, in spite of their vast differences, have found unique ways to contribute their gifts and talents to the world. In line with Armstrong (2011), I can concur that the neurodiversity that I have learned to understand and appreciate in those who so generously volunteered to help me with this study and might very well carry within are those differences that we as a human species need for our very survival. At least for those in this study, the wisdom, giftedness, and discernment that these individuals shared has allowed me to put forth what I believe to be the most comprehensive theory of sensory-cognitive difference to date for those with ASD. With these thoughts in mind, I believe that there is a growing body of expertise on the topic of ASD within the ASD community, and it is my recommendation that policymakers consider those with this condition in their decision-making processes in the future.

Limitations of this Research

With a belief that understanding about the topics of this inquiry would naturally emerge through human engagement, I chose a method of study intended to develop human understanding through deep and purposeful inquiry. Within this method, I considered how things occurred with the goal of producing a study that would be both descriptive and emergent. The study emphasized the particulars, rather than the generalizable, and led to findings with negotiated outcomes and reconstructed realities between myself and the participants.

As such, the final proposed theory is intended to reflect *felt knowledge*. But within this approach, the study was likely limited by my skills as a novice researcher, which required me to be both flexible and inductive in my level of insight and reflexivity.

I was also somewhat limited in my involvement with several of the participants, given other demands on my time and theirs. In addition, I found that my world-views and biases likely affected my lens of interpretation in ways that I was unable to control.

Within a frame of sociocultural constructivism, I determined that at least for this study, knowledge about the topics of this research could feasibly be socially constructed and shared through language. As such, I determined that the knowledge that came out of this inquiry would be active and created, then tested and modified through my communications with the participants. This allowed for an evolution of consensus that was valued primarily within my stance, process of reflexivity, and basis for reporting of the data.

Because of my selection of framework, however, I relied on the communication of shared insight so I was not able to include the voice of the non-vocal members of the autism community (with the exception of one expert professional), which I see as a major limitation to the findings of this research. Within my definition of knowledge, this study was also limited by its ability to be generalized across the broader autism spectrum. Within constructionism, it must also be assumed that cause and effect do not exist, except to ascribe attributes from one person to another. Therefore, within my selected frame of inquiry, I recognize that the study was limited for its interpretive usefulness within a western ontology to inform classification systems or ideologies as these require cause and effect, which are not to be assumed within my chosen lens of interpretation. Given that the outcomes target societal concerns and challenge traditional assumptions, I am able to only share information that is relevant to those involved in the inquiry.

With the intent to move beyond descriptors for the purpose of generating or discovering a new theory about a particular process or action, I selected to conduct this study within a constructivist branch of grounded theory methodology. In this method, it was my intent to *construct* meaning within the belief that the data do not provide a window on reality; rather, the *discovered* reality arises from the interactive process between researcher and participant with a resulting narrative that is both analytical and literary. With this sense of co-creation in mind, I chose in advance of collecting the data to focus on a process or action over time and to develop a theory to explain it. This forced me to accept that my findings, while suggestive, would remain incomplete and inconclusive.

Within this, the study was also limited by my inability to entirely put aside the pre-conceived ideas or notions I had about the theory from the outset. This may have, in some ways, prevented the *truest* theory from emerging. This type of methodology also requires full saturation of the data and while I felt that saturation for the themes I was pursuing was achieved, I in no way saturated all themes that emerged. As such, and although doing so might have been impossible, the study was limited by a lack of saturation for a number of the secondary themes. My access to participants, especially those who are lower functioning or less vocal, was an additional limitation to this study as was my reliance on transcribed audio recordings, which in the final stages of checking and rechecking the data, grew more difficult to manage, given the sheer volume of data that I had collected and my inability to handle it all. Within my grounded theory approach, it was also possible that the very expectation of a final outcome/theory influenced the final theory.

The ways that grounded theory studies use existing literature are contested between the leading theorists. While some suggested that early and deep engagement with the literature could give foundation to the inquiry, others believed that the literature is overly influential and prevents the truest theory from evolving. In this inquiry, I chose to use a very thorough understanding of the literature to guide my inquiry. This knowledge of the literature along with my own work as a professional in the field likely had a heavy influence on my thinking and could, thus, be seen as a limitation of this study.

In an attempt to bring deep meaning and understanding to the condition of autism within this study, the need to question whether or not I got it right, whether my accounting was accurate, and whether it was even possible to get a *right answer* in this study forced me to look deep within myself and within the participants to determine if the research was of high quality. I also had to carefully consider my accounting methods. In criticism of these, I could see that the trustworthiness, validity, and reliability of this study was somewhat limited by the need for additional prolonged engagement between me and the participants. I could have gone on for years with some of the participants in the study, but I naively predicted the time needed with each participant. So, because I had already become a nuisance to those who were told at the outset "that the study would only take about an hour and a half of their time," my need for additional engagement was not always met. It was also much easier to establish trust, understand cultural differences, check for misunderstandings, and negate distortions introduced by me for some of the participants, especially for those living over-seas. Some of those in the study were also not very vocal, so these things took more time because they needed to be

communicated through writing. This led to the result that the individuals who were harder to access were less heavily represented in the data than those with whom I was able to easily talk (both literally and as a function of scheduling). Additionally, while the study intended to use 30-45-minute interviews, once the data set grew to more than 300 pages, it was simply too large to work with or manage, and I reached some internal critical limit where I couldn't find anything within it. So near the end of the study, I stopped transcribing all of the follow-up calls and, instead, took bullet-point notes to enter these new ideas into the data. This likely cost the study some valuable insights that I missed from the phone-call/note-taking process alone and might have introduced data that were not as representative as the transcribed data would have been.

I addressed trustworthiness through the triangulation of detailed self-disclosure of my researcher's stance, member-checking the data and the assumptions with several of the study's participants, and the reporting of all data using as much as was possible *thick rich description* and direct quotes. I added a reliability checking procedure with three expert professionals as the study evolved. But, within these, I found my disclosure needed embellishment and was likely still lacking, my member-checking was limited to those who were more verbal, and the expert professionals added elements to the study that might have been overly influential.

The study was further delimited by (a) its selection of participants as either affiliates of USAAA, or as my own affiliates; (b) reliance on data that could be verbally articulated by phone or e-mail, which was less personal and likely introduced an element of reservation for the participants; and (c) my choice of data analysis, which ended up

being quite cumbersome and taxing for me as a beginning researcher. All of these limitations and delimitations make replication of the study difficult to impossible.

Recommendations for Future Research

Given the rich and insightful voice of several highly self-aware participants who have lived with and interacted within autism communities for most of their lives, I feel comfortable forwarding their thoughts to inform and recommend future research. Based on the thoughts of those in this inquiry, the following recommendations for future research seem logical.

- The rise in autism might have both a genetic and an "environmental injury" component. For that reason, on-going research into causality that includes both epigenetics and environmental loading theories seems appropriate.
- While issues with socialization are present in autism, it is recommended that these be researched for their effects for the individual with ASD, instead of from the perspective comparing NT and ASD groups or training ASD groups to act normal. Research on what social skills to teach and how to teach social skills should be directed by those with the condition. In some areas, I believe NTs have a lot to learn about social interaction from those with ASD.
- On the research topics of intellectual disability, clearly existing measures do not tap the potentials of those with ASD due to challenges with motor planning, processing speed, and difficulty communicating. These are furthered hampered by sensory issues such as florescent lights or competing background noises in most school-testing environments. As such, new studies that re-think intelligence, that attempt to find ways to truly capture learning

styles and strengths, and that explore testing methods that are capable of allowing those with ASD to truly demonstrate their unique skill sets seem important. Until testing for those with ASD can change dramatically, however, it appears that the use of existing assessment tools might be less valid than the clinical reports of those who work closely with these individuals. In other words, estimates about intelligence might need to be assumed from those who see the gifts. I believe that based on this study, it also seems relevant to seriously question the construct of intelligence in autism until further tools have been developed to re-open the discussion. This will require considerable research on the topic of different forms of intelligence in autism.

- Research on visual languages and visual communication tools for their usefulness with non-vocal individuals was recommended by one of the participants as a method that might be able to reach some of those who appear low functioning.
- As traditional definitions of learning are also negatively affected by ASD, based on this research, it appears that much more insight is needed surrounding the topics of interest-based focus and long-term memory for their applications within learning and performance.
- Given that this study proposed an alternate theory about the sensory and cognitive differences of those with ASD, much more will need to be done to verify or refute the theory of sensory-cognitive difference beyond this group to the broader autism spectrum.

- To do this, it appears that the topic of sensory processing needs to be seriously re-considered for those with ASD, especially within its relationship to cognitive development. Specific areas of research that seem relevant based on this research include: (a) the extreme states that hyper- and hypo-responding can take; (b) the role of sound; (c) the effects of lighting; and (d) the possibility of a learning style difference between the *verbal facts people* and those who are highly visual for their difference in sensory responding.
- More challenging still, I think this study calls for a re-emergence of the topic of cognition in autism. What is clear to me is that a very different form of cognition is present for those in this study and, in spite of over 800,000 studies in the literature, to my knowledge, none seem to have fully captured the strength-based evolution in cognition that I saw in the members of this inquiry in entirety. I think that because much of the research on cognition has focused heavily on what those with ASD can't do or what they can or can't do compared to NTs, the body of research on autism has failed to witness the emergence of *whole* individuals with very specific strengths that don't exist within the general population. Specific areas within this topic of research call for studies in (a) the strength-based skills of hyper-focusing; (b) interest-based learning; (c) long-term, sensory-based memory; (d) creating or envisioning the big picture; (e) recognizing patterns, rhythms, and anomalies; and (f) processing speed as it relates to intuitive thinking, problem solving, and communicating. In addition, more research is needed within the topic of communication as so many of these individuals are clearly highly verbal, but

struggle with vocalization. Once the cognitive style of those with ASD is better understood, then research on how to teach to these strengths must follow. It is my opinion that the body of research geared towards finding new ways to fix deficits or normalize those with ASD is fully saturated. However, learning more about the sensory-cognitive continuum in ASD should result in a better understanding of the strengths and needs of those with ASD. In turn, this will improve understanding and inform teaching toward better meeting the needs of those with ASD.

- I think more research is needed to understand those variables that have contributed most to helping adults with autism become contributing members of society. Too many youth with autism have no future until the systems that are in place can teach them what is needed to overcome their hurdles and find use for their strengths. Within this, I believe that much more research is needed to adapt educational systems for school-age students with ASD and to develop continuing education for young adults who have aged-out of public school programs.
- Finally, I think this study calls for much more research on what those with ASD can do, within holistic whole-person perspectives, instead of what they can't do when compared to the developmental *normal*. This means that at least for those with ASD, a shift away from reductionist and developmental ontologies is long over-due.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD

PERMISSION

UNIVERSITY of NORTHERN COLORADO

Institutional Review Board

DATE:	October 12, 2015
TO:	Marlo Payne Thurman, M.S.
FROM:	University of Northern Colorado (UNCO) IRB
PROJECT TITLE:	[779032-3] First person perceptions on intelligence, cognition, and sensory processing in autism spectrum disorders
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	October 12, 2015
EXPIRATION DATE:	October 12, 2016
REVIEW TYPE:	Expedited Review

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB has APPROVED your submission. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on applicable federal regulations.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of October 12, 2016.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

Marlo -

Thank you for the all of the clear and thorough amendments to your IRB application. All items requested have been addressed and you may proceed with participant recruitment and data collection. Be sure to use all revised/amended materials and protocols developed through the IRB process.

Best wishes with your very interesting research. Please don't hesitate to contact me with any IRB-related questions or concerns.

Sincerely,

Dr. Megan Stellino, UNC IRB Co-Chair

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

APPENDIX B

SAMPLE CONSENT FORM

UNIVERSITY of NORTHERN COLORADO

CONSENT FORM FOR HUMAN PARTICIPANTS IN RESEARCH

Intelligence, Cognition, and Sensory Processing in the Autism Spectrum
Lead Investigator: Marlo Payne Thurman 720-887-8407
Research Advisor: Dr. Robin Brewer 970-351-1661
University Affiliation: University of Northern Colorado, School of Special Education

Purpose of the Study

I am conducting this study to explore and understand intellectual, cognitive, and sensory processing difference in adults with autism spectrum disorders so that I can find new ways to support the needs of children with ASD. Please read this form carefully and ask any questions you have before agreeing to take part in the study.

What I Will Ask You to Do

If you agree to participate in the study I will:

Interview you in a 30 to 45 minute initial interview to discuss your views on intelligence, cognition, and sensory processing. The interview will be recorded and transcribed. In the transcription process your name will be replaced with a pseudonym.

Once I have completed the initial interviews, I might contact you a second time to ask additional questions or to clarify some of your answers from our first interview.

Finally, once I have compiled some of the findings and assertions that I gather from the transcribed interviews, I might contact you a final time to go over some of my assumptions to verify with you that my report is consistent with the things that you have shared with me.

[ ] Please place your initials here to indicate that you have read and understood this page.

Risks and Benefits

I do not think that there are any risks to you for participating in this study. Some people might feel anxious are embarrassed, when talking about themselves, but at no time will you be forced to talk about or share experiences that you don't want to. There are also no benefits for participating in this study, so your participation is entirely voluntary. I do hope this study will help me to better understand intelligence, cognition, and sensory processing in ASD so that I can understand and support the needs of individuals on the autism spectrum.

Compensation

You will not receive any compensation (money or rewards) for your participation. There will not be any costs for you to participate in this study.

Confidentiality

The records of this study will be kept private. In my report, I won't use your name or any information that would allow others who see my work to know who you are. During the study, my research records will be kept in a locked file for which I alone will have the key. After I have completed my research, my records will be stored in a locked filing cabinet at the University of Northern Colorado for three years.

Statement of Consent

Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions, please sign below if you would like to participate in this research. A copy of this form will be given to you to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact Sherry May, IRB Administrator, Office of Sponsored Programs, 25 Kepner Hall, University of Northern Colorado, 970-351-1910.

_____ _____

Signature Date

If You Have Questions

The researcher conducting this study is Marlo Payne Thurman. Please ask her any questions you have, at any time. You may contact Marlo Payne Thurman at 720-887-8407 or by e-mail at 2econsultingservices@gmail.com.

A copy of this document will be kept for three years at the University of Northern Colorado in Greeley, Colorado.

_____ _____

Researcher's Signature Date

[ ] Please place your initials here to indicate that you have read and understood this page.

APPENDIX C

RESEARCH QUESTIONS

Research Questions

What are your thoughts about intelligence in ASD?

Possible follow-up questions:

Have you ever taken an IQ test? If so, what was that like for you?
What have you been told about your intelligence? Does that feel accurate? Why?
What do you remember about the experience of taking standardized tests like IQ tests?
Tell me your ideas about IQ testing for those with ASD.

What are your thoughts about IQ test scores and their ability to predict academic success?

Possible follow-up questions:

What was school like for you?
What kinds of things were very easy or very hard for you to do in school?
Do you think your intelligence matches up with how you performed in school?
Why or why not?
Tell me any other ideas you have about education for those with ASD.

What are your thoughts about IQ test scores and their ability to predict success in the workplace?

Possible follow-up questions:

Are you employed?
What do you do for work?
What do you like and dislike about your job?
What do you find very easy or very hard to do at your job.
Do you think that your intelligence matches up with how you perform in the workplace?
Why or why not?
Tell me any other ideas you have about vocational success for those with ASD.

Do you think that IQ scores do a good job of describing cognitive abilities for those with ASD? Why or why not?

Possible follow-up questions:

How do you define cognitive ability?
What do you feel are your cognitive strengths?
What do you feel are your cognitive weaknesses?
Do you think your cognitive abilities are reflected within your IQ?

Can you tell me any other ideas you have about cognitive ability for people with ASD?

What are your thoughts about cognitive difference for those with ASD?

Possible follow-up questions.

Have you heard about the various theories that have tried to explain cognitive difference in ASD?
Do you think any of these theories applies to you?

What are your thoughts about sensory difference for those with ASD?

Possible follow-up questions.

Can you tell me about any sensory processing differences that you have.
Do you think that any of these affected the way that you performed in school?
Do you think that any of these affect you in your job?
Do you think that your sensory processing differences are tied to some of the cognitive processing differences that you shared? Can you explain?
Are your sensory differences a problem for you? Are there any of them that you like?

Do you think that the cognitive and sensory processing differences that you talked about are tied to performance on IQ tests for those with ASD? Why or why not? If yes, how do you think they are related.

Can you tell me your thoughts about whether or not you think sensory processing is tied to intelligence?

Can you tell me your thoughts about whether or not you think sensory processing is tied to cognitive performance?

From your experience, is there anything else that you think might help me to better understand the topics of intelligence, cognition, and sensory processing in ASD?